ELECTRICAL REVIEW

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ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

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Jarriant's Accumulators.

In 1860, when Mr. Gaston Planté projected his accumulator, electricity was yet in its infancy, and it was only among a very few learned men that we could have expected to find correct ideas on the phenomena, the explanation of which seems to us quite natural in our days. Consequently it is not at all astonishing that, at that epoch, the accumulator did not meet with the welcome it would receive in our present time.

The scientists discovered therein a very interesting instrument, but they could not say it was an industrial implement, because electricity had then been proclaimed of little use and merely fit to work the telegraphs and other instruments of precision.

But in a measure, as ideas widened, and, little by little, accumulators were put into requisition for services which, though for special purposes merely experimental, did never theless foreshadow the use they might be put to at a future day.

Finally, when electricity had really entered into the way of industrial application, the accumulators were again resorted to, and with what a zest our readers will most assuredly remember.

At first it was a most mysterious accumulator, costing next to nothing and rendering a prodigious accumulation; afterwards, they could no longer deny a certain degree of relationship between the newly born child and the one already grown of Mr. Planté. But what a difference! What improvements accomplished from one generation to the other! It was the complete solution of the whole electrical problem.

Unluckily, all such wonderful promises vanished with the mystery, and, by-and-by there remained only a twin brother (*alter ego*), better clad, according to the opinion of some, and miscarried according to others, of Mr. Planté's accumulator, and yet a twin hardly fit to live in spite of the cares of its numerous god-fathers.

All that fuss was, nevertheless, productive of some good results, that is to say starting the searchers on a scent in the right direction, and which might lead them to important results.

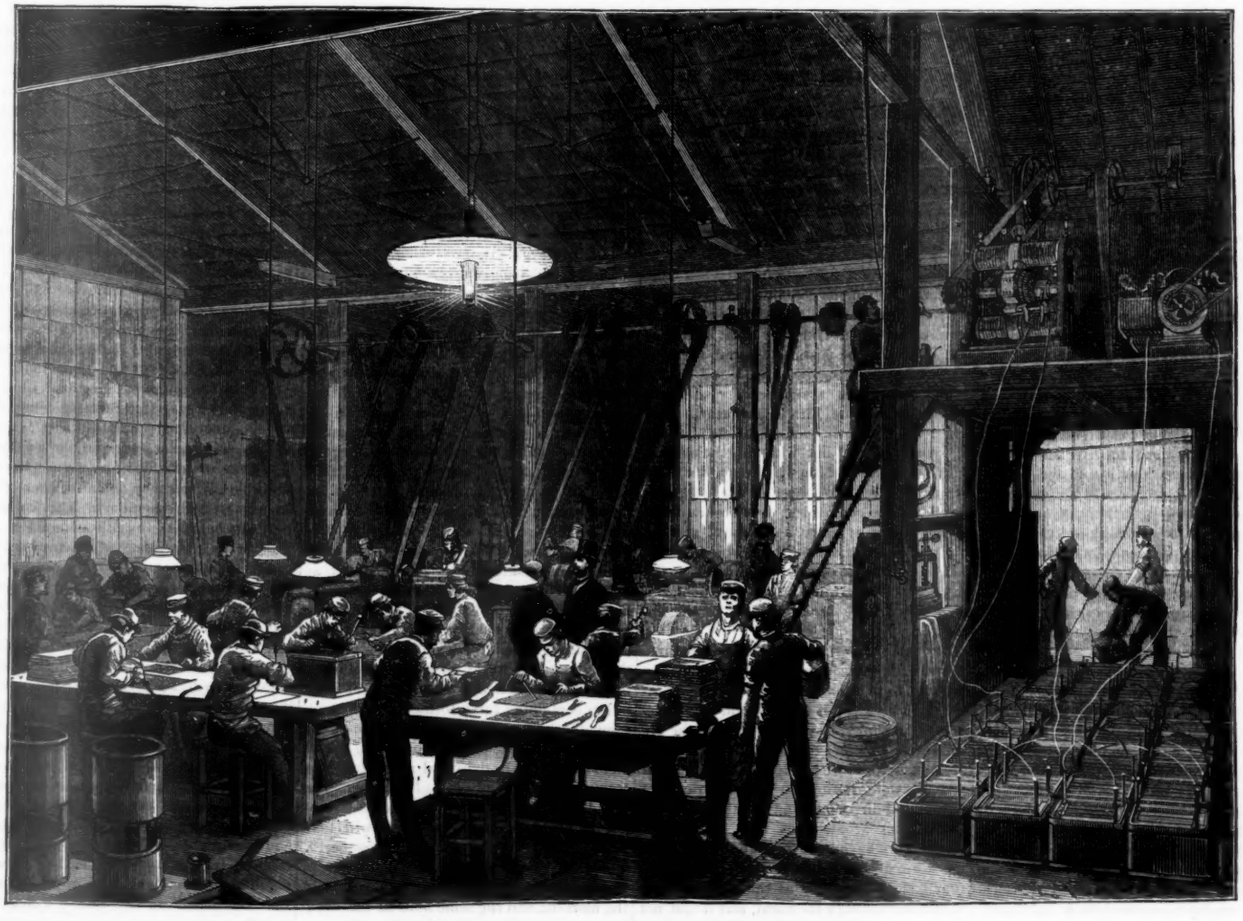
Indeed, accumulators of all shapes and colors surged on all sides; lead, zinc, copper, potassium, sodium, ammonium, etc., etc., were, by turn, associated with all the possible solutions, and all the essays made within twenty years reappeared after a new baptism.

To-day, when the enthusiasm has died away, we were going to say, but we better say, has become more calm and reflected, we are obliged to acknowledge that they have not accomplished quite all that was predicted, but the question is better known, the true usefulness of the accumulator is better understood, and, in consequence thereof, we do not expect so much from it; thus we no longer look for marvels in the matter, but only for some sure and regular service, and, above all, a *durability* which will repay the costs of installation.

For that reason, a great number of searchers have returned to the study of the Planté's accumulator, and simply endeavor to improve the *desiderata* it may present under an industrial point of view; that is to say, to abridge as much as possible the time necessary to the formation, and to construct the apparatus in such manner as to insure a sufficient durability.

Such are the considerations which seem to have guided Mr. Jarriant, Sr., in the manufacture of the accumulators he puts on the market; since he does not aim at a work of invention, but rather of good construction.

The elements of his accumulators are small, flat cases about 2 centimeters ($\frac{3}{4}$ inches) thick by 25 cent. (10 in.) high, and 22 cent. (9 in.) wide, constructed with leaden plates 2 millimeters ($\frac{1}{12}$ inch) in thickness. That case is punched through with a great number of apertures, 2 millimeters ($\frac{1}{12}$ in.) wide, and 3 cent. ($1\frac{1}{4}$ in.) long, so as to form a kind of cage, the inside of which is filled with laden shots and minium. Each accumulator is composed of six such cases, three positive



ELECTRIC LIGHTING OF JARRIANT'S SHOP, PARIS, FRANCE.

and three negative, which are enclosed in a wooden box lined inside with sheet-lead. The cases are separated one from another by strips of ebonite, which hold the sundry pieces together in their places. The box is filled with acidulated water, and so adapted that it can be hermetically closed for transportation or shipment.

The small quantity of minium, mixed with the leaden shots, is used to produce, under the action of the current, a deposit of metallic lead, which solders the case and the shots into a continuous mass for conductibility, although it remains very finely divided to favor the loading, with a very extensive surface to augment the power of storage. The complete apparatus with acidulated water weighs about 53 kilogrammes (120 lbs).

As we see, Mr. Jarriant does not attempt to reach extreme light weight in his manufacture, and he is right; because we often forget that light weight is incompatible with solidity and durability in the production of a great accumulation. Indeed, Mr. Plante, long ago, had demonstrated the changes which the leaden plates undergo, little by little, in passing through successive loadings and unloadings; and when we consider a thin leaden plate as formed of two layers having each different functions, the outside layer, which is the real accumulator, and the inside layer which constitutes the skeleton frame of the apparatus, and is at the same time the electric conductor, we see that the formation can increase the power of accumulation only at the expense of the solidity and conductibility.

Consequently whenever we aim at obtaining extreme light weight by using very thin plates, we produce an accumulator, the frailty of which will increase constantly, and which will be destroyed by use precisely when its formation would permit us to expect a useful service.

Perhaps we could conciliate those adverse conditions by using different materials to perform separately each one of the functions that one plate must fulfill; for instance, by forming it with a layer of charcoal covered with a layer of lead, but the experiments, which have been heretofore made in that direction have, probably, not been successful, since they have produced no industrial applications.

We have not had the chance of verifying the *constants* (power and resistance) of the Jarriant's accumulator, but its electromotive power is evidently the same as Plante's, and its resistance must not be above a few hundredths of 1 ohm. As to the capacity, we will not attempt to make any appreciation, because it is evidently very variable according to the degree of formation. We would be liable of being charged with exaggeration by giving figures obtained, perhaps, by the use of very ancient apparatuses, and which might no longer apply to others of more recent formation.

The installation made by Mr. Jarriant in his shops, stores and apartments seems to us quite a success. According to the dispositions and uses of the premises, he has judiciously used either regulators or incandescent lights, and a mixture of both ways of lighting.

Thus in his offices, machine shops, and formation shops for accumulators, he generally uses one of Siemens' regulators, suspended in the middle of each room, whilst incandescent lights, placed near each workman or employe, secure him a light more than sufficient for the most delicate work.

The illustration herein, Fig. 1, represents his shop on the first floor, in which we see the electrical generators, one Gramme's machine, one Siemens' machine, the accumulators in formation, and lastly, the different phases of the construction.

The effect was thrilling, and more so when the manufacturer, with a certain coquetry, did introduce his visitor into the room in the dark, and instantly placed him in a flood of light by means of an accumulator placed near the entrance. The complete installation of Mr. Jarriant consists of 4 Siemens' regulators, and 100 incandescent lights, which are fed by 96 accumulators loaded during the day.

Mr. Jarriant is now preparing the complete installation of the lighting of the studies of the College Saint Barbe, which will be effected by the use of 250 Swan lamps.

The current will be obtained by means of a steamer, of 20 horse-power, working a Gramme machine, the current of which will be stored during the day in batteries of accumulators.

While engaged in that installation, Mr. Jarriant has been led to an experiment of some interest, since it gives information on the cartage of accumulators. Indeed, some of the rooms of the College Sainte Barbe, not yet having at present any installation for their lighting, Mr. Jarriant sends there every day a cart load of accumulators, which are returned to his shop in the evening, after their service at the college. By this simple transportation, which is an accident and not a preconceived system, Mr. Jarriant has had an occasion to observe the numerous inconveniences which would be encountered, if this exceptional case should be turned into a regular system. He has moreover observed that apparently contradictory fact, that accumulators in formation perfect their formation much more rapidly while they undergo a few transportations. That is evidently caused by the vibrations produced by the motion, which crack the layer of peroxide into small fissures, and thereby facilitate the increase of such layer but it is evident that if the fact should be often repeated, it would surely result in the destruction of the instrument.—*La Lumiere Electrique.*

The Electric Light Wires in the Storm.

The Boston *Transcript* says that they stated distinctly, in their account of the breaking of the wires in the great storm of Thursday, that the electric light wires remained intact, and the trouble was entirely due to the breaking of the telephone and telegraph wires. The electric lighting companies desire the publication of the following:

To the Editor of the Transcript:

Certain statements contained in last evening's *Transcript* seem to the undersigned to require correction, and they trust that you will do them the justice to permit them to state the facts.

The fire alarm system *was* "seriously damaged," and the Fire Department *was*, in a measure, "thrown back on the old methods of giving alarms," but with this the electric light wires had nothing whatever to do. The fire alarm wires, like those of the telegraph and telephone companies, were broken down by the weight of snow upon them, and the trouble would not have been one iota less had there been no electric light wires in the city. For the truth of this statement, we refer you to the superintendent of the fire alarm.

Throughout the day of the storm the three electric lighting companies doing business in this city were running their day circuits as usual. The wires of the telephone and telegraph companies, as well as those of the fire alarm, which seems to have suffered more in proportion to its wire mileage than any other system, were resting on the electric light wires in all directions, and yet there was no trouble, no accident of any kind. Nor would there have been through the night, for the storm abated before six o'clock. But at four o'clock it looked as though the storm would last through the night, and it did not seem wise to take any risk. Therefore, at the request of the Mayor, the circuits were not run.

The facts are, therefore, that in the face of a phenomenal storm of unprecedented severity the electric light wires were the only ones that stood up and worked without interruption, and that, with thousand of "crosses," owing to the breaking down of weaker wires, producing conditions which have over and over again been pointed out as inevitably dangerous, not a single accident occurred, although the electric lighting currents were in full operation throughout the day.

The deduction from the article in your issue of yesterday plainly is, that Thursday's storm demonstrated the unfitness, or at least the untrustworthiness, of electric lighting for the streets, and that a return to gas lighting is desirable. But are there no instances on record of phenomenal storms interfering with the operations of the gas lighting companies? We think that Cincinnati, Pittsburgh, Louisville, Wheeling, and other large cities of the Ohio Valley have afforded ample testimony on this point within a very few weeks.

We repeat: There was no interruption of the electric light service from any cause within or related to itself, but simply as a precaution against possible danger, growing out of the troubles of other wire systems, caused by an almost unparalleled storm.

THE BRUSH ELECTRIC LIGHTING CO.
By Hugh O'Brien, Treasurer and Manager.

THE NEW ENGLAND WESTON ELECTRIC LIGHT CO.
By J. H. Alley.

THE MERCHANTS' ELECTRIC LIGHT AND POWER CO.
Wm. A. Hovey, President.

The Coming Grand International Exhibition of the Franklin Institute.

FLATTERING PROSPECTS OF SUCCESS—CONTRIBUTIONS PROMISED FROM EMINENT SCIENTISTS IN EUROPE AND AMERICA—WHERE THE BUILDINGS WILL BE ERECTED.

Philadelphia has been the scene of the grandest celebrations and exhibitions that have been held in America, if not in the world, and so eager are her citizens, by reason of their various business interests, to continue her prestige in this respect that one display is barely concluded before another is conceived. Being the chief manufacturing city of the country, she also takes the lead in the science of mechanics, and there is probably no city in which there is such a happy combination of the sciences—mechanics, literature and art.

The next display in Philadelphia will be in keeping with the scientific researches of her citizens, and will be an honor to them and to the country. This will be the grand International Electrical Exhibition, under the auspices of the Franklin Institute, and promises to excel anything of its kind that has ever been held. The idea was conceived more than a year ago, and the preliminary work of planning the exhibition was begun. In February, 1883, Congress passed a resolution to permit all apparatus intended for the exhibition to be admitted to the country free of duties, and the Secretary of the Treasury was directed to make express rules for the importation of such apparatus as would further the interests of the display. During the closing months of last year a general announcement of the intention of the Institute to hold the exhibition was made throughout the world, which was followed by the preparation and circulation of pamphlets containing full information and directions to those who may be desirous of exhibiting. All articles and goods to be placed on exhibit must be delivered at the building between the 11th and 30th of August. The grand opening, for which arrangements cannot be made so far in advance, will take place at noon on Tuesday, September 2. The exhibition will be open daily, except Sunday, between the hours of ten o'clock in the morning and the same hour in the evening, until Saturday, October 11. No premiums will be awarded by the Institute, but a board of examiners will be appointed to prepare a report, and the Institute will, if it is desired, provide expert tests of any apparatus at the expense of the exhibitors. The circular also contains complete information as to transportation, customs, regulations, patent rights, insurance, etc., and gives the classification under which the Institute will admit exhibits.

All arrangements for the exhibition building were entrusted to the care of a special committee by the board of managers some time ago, and the work of securing the necessary ground, and drawing the plans and specifications, was at once entered upon. This done, proposals were advertised for and received, and for the purpose of considering them a special meeting of the Board was held at the Institute on Friday evening, President Wm. P. Tatham in the chair. Three of the more prominent builders of the city were found to differ in the amounts of their bids by only $200 or $300. The lowest was Mr. Jacob R. Garber, who bid $80,000, and the contract was awarded to him.

The site of the building is the lot of the Pennsylvania Railroad Company at Thirty-Second Street and Lancaster Avenue, which was granted to the Institute free of charge for the purposes of the exhibition. The lot is in the shape of a trapezoid, whose parallel boundaries are formed by Thirty-second and Thirty-third Sts., the northern confine being Foster St., while on the south is Lancaster Ave. The buildings were designed and their detailed specifications drawn by Mr. Joseph M. Wilson, of the firm of Wilson, Brothers & Co., architects, who is also a member of the Building Committee of the Board. The entire lot, two acres in extent, will be enclosed, floored and roofed into almost one immense hall, free from all obstructions except the columns necessary to the support of the roof.

The main building will be rectangular, having a length on Foster Street of 283 feet, and a breadth of 160 feet, extending from Foster Street to Lancaster Avenue on Thirty-second street, and only part of the distance from Foster St. to Lancaster Ave. on Thirty. second Street. A tower sixty feet high will be situated at each of the four corners of this building. One central arch of 100 feet span and 200 feet in length, of the Gothic style of architecture, will cover the greater portion of the space occupied by this building, while two smaller ones, having a span of thirty feet and running parallel to it on either side, will join the towers. The building will have second-story apartments at its ends on Thirty-second and Thirty-third Sts., respectively, with stairways leading up in the towers from the ground floor. The towers themselves will be three stories high. Two long and narrow hallways will afford communication between these apartments. The remainder of the ground will be enclosed by a large triangular building one story in height, and joined to the main hall. The main entrance to the building will be at the corner of Thirty-second Street and Lancaster Avenue, another at Thirty-third St. and the Avenue, and one at each of the other towers. Five exits are provided for on the plans, but desirable changes may hereafter be made in the number and situation of both entrances and exits before the work is completed. The structure is intended only for temporary use, and its foundations are to be constructed entirely of timber, mostly hemlock. The roofs of the Gothic arches of the main hall will be made of white pine, furnished with skylights, and will conform to the slight grade in the ground, while the roofs of the adjoining buildings will be horizontal. The roof of the entire building, except portions over the doorways and towers, which are to be shingled, will be covered with three thicknesses of roofing felt. Doors, windows, closets, parcel rooms, etc., are provided for, and the Institute reserves the right to make any changes in the plans that will add to comfort and convenience. The whole of the work of building is to be completed in the best workmanlike manner and with approved materials on or before the 15th of June. The building will be as large as the dimensions of the ground will permit, but the managers of the Institute state that it is probable more room will be solicited by exhibitors than can be furnished. In this event the managers have in view the unoccupied depot of the Pennsylvania Railroad Company at Thirty-second and Market Streets. This building would do heroic service in such an emergency, which, unless met, might so diminish the lustre of the exhibition as to be a cause of deep regret both to the Institute and to the city. It is believed by the managers of the Institute, in view of the past liberal action of the railroad company, that it will also gladly tender them the free use of the depot if it becomes necessary, but that it

is unwilling to do so at present, as it may have need to put the building to some other use in the meantime.

If more room is needed and the company grants the use of the building, the latter can be easily connected with the main exhibition buildings by means of a bridge across the street. Engines, boilers and machinery necessary to furnish and distribute power over the exhibition buildings to exhibitors will be provided, but the plans for the same have not been completed. This work is in the hands of a special committee, and will be prosecuted rapidly. The main hall of the exhibition buildings has a capacity for seating 6,000 persons, and an audience of fully 10,000 could be easily assembled within it. It has been proposed by some that after the exhibition it could be used as a music hall, or for some similar purpose, and this consideration was a factor in the design of the structure, and it was so planned that it will be complete when the adjoining buildings are torn down.

At the meeting of the board of managers on Friday evening the guarantee fund was considered, it being desired to increase the amount of the fund already subscribed for from $35,000 to $50,000. It is the object of this fund to provide against a possible want of means to meet expenses, in which case each subscriber to the fund will be called upon to pay his *pro rata* share. At the last exhibition of the Institute in 1874 nearly the same expenses for buildings, etc., were incurred as are estimated for the coming exposition. The former was a great success, and still more is expected to be realized by the coming one. There is therefore little likelihood that any dearth of money will make it necessary to call upon the subscribers to the guarantee fund.

The City of Angels With its Southern Sun and its Electricity.

HOW THE MAST SYSTEM WORKS IN CALIFORNIA.

LOS ANGELES, CALIFORNIA.—East of the Rocky Mountains, and east of the great river, live many intelligent people who think of Los Angeles as lying directly on the Pacific coast, and were they to be suddenly let down here, would immediately begin to look around for the boundless blue sea. And this lack of correct geographical knowledge is not so great a wonder. One can't know everything, especially the details of matters two or three thousand miles away. It takes a mind of no mean powers and not a small fraction of time to get hold of even the important facts right at one's door, but to grasp all that lie within the entire horizon would be labor for a mind angelic.

Los Angeles, then is not "a city by the sea." It is eighteen miles from the coast on the west, and twenty-three miles from it on the south, where the ocean makes a long curve eastward, forming the beautiful San Pedro Bay, Peaceful Santa Monica and Willmore City, the property of the celebrated American colony, are respectively the western and southern seaports and seaside resorts of Los Angeles. The former stands upon a bend of the shore formed by the Santa Monica Mountains, which push fairly down to the water's edge, and serve, in some degree, to break the force of northern winds. The latter is located on the northern border of San Pedro Bay, and is finely sheltered by a broad headland, which runs down to the sea on the east. Of both these places more will be said in a future letter.

However much Los Angeles may be lacking in sidewalk and pavements, and lacking she is, to a most unfortunate extent, she is beyond dispute, one of the best lighted cities at night in the Union. From her Main street to the most outlying alley, the paths of her citizens are distinctly revealed to them, no matter how dark the night.

ELECTRICITY DOES IT,

and only thirteen months have been spent in making the change from uncertainty and danger to confidence and security in walking or driving at night. The great city of 200,000 people, which stands on the southern shore of Lake Erie, cannot hold a candle to Los Angeles in this particular. For a town of only 25,000 inhabitants the provision has been lavish, yet most wise. One of the daily papers, speaking of the masts there erected, said: "The new system of lighting has increased the value of property in the city fully $1,000,000." A prominent real estate dealer states that he gets 25 per cent. higher prices for lots on remote streets than he got under the reign of gas light. Los Angelans note this advance, and make no complaint about increased taxes.

A citizen said yesterday: "In so great favor is the Brush Electric Light held, that if the question of return to the old plan were submitted to the people, not one in twenty would vote for a change." In Los Angeles the electric light is emphatically the poor man's light. In what other city is it so? Usually, only the central and most wealthy portions are lighted. The high price of property in such localities forces the poor man to go further out and into the darkness for a home. In this city the light has gone out to this class. The owners of small homes are reaping their share in the rapid rise of the land. More than this, real estate dealers, perceiving the immense advantage derived from the light, are erecting masts at their own expense, to light additions of territory they are laying off in lots. Mr. H. W. Mills, a leading man of this class, has already put up a mast on such property near the depot. The light is now burning, and costs Mr. Mills $360 per year. Are there no hints in these facts for other cities, for other land owners? Three facts contribute to the success of the electric light system here. First, there are many masts for a town the size of Los Angeles. Second, each one is so located as to get from the fewest lamps the greatest amount of light for the largest possible space. Third, every mast wears a

ROUND FLAT HOOD,

or reflector, which throws the light to the ground, instead of letting it pass out through the atmosphere in all directions, doing little, if any good. With this contrivance Los Angeles obtains twice as much light from four lamps—the largest number on any mast—as Cleveland gets from eight lamps. A Cleveland gentleman wintering here, declares the amount is four times as much, but he is altogether too enthusiastic. In the city are fifteen masts one hundred and fifty feet high. Two have four lamps of 3,000 candle power. The remaining thirteen have three lamps of 3,000 candle power. Besides these there are three masts sixty feet high, each bearing one lamp equal to 3,000 candles. Then there are one hundred and forty private lamps, the power equal to 2,000 candles. About thirty-five of these are in the streets, in front of stores. The remainder are in shops, stores, and offices.

The area lighted by the Brush Co. is about twenty times that formerly illumined by gas, at an expense, for this large area, of about twice the cost of gas for the small territory. Still the citizens are petitioning for more of the good thing. So far as the corporation is concerned the city light is exclusively electric. Not a gas lamp has burned for months. The total expenditure for the grand illuminator has been $100,000, fully one-half of which was used for the public lights.

A Bi-Sulphide of Carbon Engine Company with a Capital of $25,000,000.

The announcement is made from Chicago of a new and remarkable motor, known as the "Triple-Thermic Motor," working with vapor of bi-sulphide of carbon. A company has been organized, with a capital of $25,000,000, to sell the motors. Ex-Governor Hubbard, of Texas, and ex-Collector Baird, of Boston, are mentioned as having taken an interest in the company. The Chicago dispatch says that a prominent engineer of Chicago, in giving the result of his examination of the new motor, says: "I saw a 15-horse-power boiler, with very little fire under it, generating steam, which generated the new motor, which in turn ran an engine of 60-horse-power."

The perfect steam engine will be one in which every particle of pressure in the steam is utilized. In other words, the waste vapor would come out cold, and without pressure. The idea of utilizing the heat of waste steam to do some useful work is as old as the steam engine, and the bi-sulphide of carbon has been tried by hundreds of experimenters on account of the low temperature (118 degrees) at which it flies into vapor. As an adjunct to a steam engine, the waste steam volatilizes the bi-sulphide, and this vapor does some work. Such an apparatus, in one shape or another, has been tried for years, and one, known as the Ellis engine, was shown at the American Institute Fair of 1872. It was to replace the steam engine, but it disappeared. The trouble is that while bi-sulphide of carbon requires but very little heat before it flies into vapor, its pressure, and consequently working power, is proportionately low, and it is doubtful whether the work obtained from it is worth the cost of the apparatus and material. A very weak spring is easily pulled out, but the recoil is proportionately weak. It is the same story with bi-sulphide of carbon vapor. The present scheme to get power out of weakness does not appear to differ from previous attempts.

Any one interested in the matter will find it discussed in the *Scientific American* for September 28, 1872, the article going back to Du Trembley's experiments with a bi-sulphide of carbon motor about 1850.

The Storage of Electricity.

IN PRACTICAL OPERATION AT THE OFFICE OF THE BRUSH ELECTRIC LIGHT COMPANY, IN NEW ORLEANS.

Some time since the Brush South-western Electric Light Company received a Brush storage battery, consisting of twenty-one cells—seven sections of three cells each—and a few days ago the battery was placed in position in the office of the company on Union, between Baronne and Carondelet Streets. The battery, as its name implies, is for the storage of the electric current ready for use at a moment's notice.

In the office of the Brush Company a number of Swan incandescent lamps have been connected with the storage battery, and they emit a beautiful and steady light. The lamps are small, round, neat glass globes, with a carbon filament inside, and can be attached to an ordinary gas bracket or pendant, and are very ornamental.

The storage battery occupies a space about twelve feet long by one foot in width, and can be charged from the arc light circuits during the day time while the street lights are not in use, or even at night while the lights are burning. The current enters the battery through a kind of meter, which works automatically, cutting off the current as soon as the storage battery has been fully charged.

The amount of electricity required to charge the battery is measured by the time required in completely charging the battery, and an automatic clock commences to run when the current flows in, and stops when the flow is checked, keeping account of the time required. A small switch, similar to a gas cock, is attached to each burner or lamp, and one or more can be extinguished in a room without affecting the others.

The battery in use at the company's office has a capacity for supplying twenty incandescent lamps, each one of which is sufficient to illuminate an ordinary-sized room. The light is clear, strong and much steadier than if the current came direct from a dynamo machine, as in the latter case the pulsations of the engine affect the light, and cause a perceptible flickering. The advantages of the incandescent light over the ordinary gas-light for family use are manifold, and in point of safety is far superior to any artificial light yet discovered. No heat emanates from the little globes, and there is no smoke or odor arising from the beautiful light. What the cost will be, or what arrangements the company will make to supply families with the light, has not yet been determined upon.

A Zinc-Lead Accumulator.

M. Regnier has constructed an accumulator in which the negative plate is composed of lead, covered with electrolytically-deposited zinc, the positive plate being an ordinary Planté electrode, with large surface. The latter is a long, thin plate of lead, on either side of which are two negative plates, formed of strips of riband lead, electro-zinced by electrolysis in an acid solution of sulphate of zinc contained in the glass jar forming the cell, and then amalgamated. The plates are supported by a wooden cover fitting on the top of the glass cell, and the plates are not allowed to touch the bottom by several centimeters, in order to avoid short circuits formed by pieces of lead, oxide or reduced zinc. The following data relating to this battery have been made public: E. M. F., 2.35 volts; average resistance, .04 ohm; normal current on discharging, 5 to 7 ampères; charging current, 1 to 3 ampères; capacity of accumulation, after 100 hours of formation, 100,000 coulombs; after 500 hours of formation, 125,000 coulombs; surface of the positive plate, 60 square decimeters; surface of the negative plate, 5 square decimeters; weight of the positive plate, 2.800 kilog.; weight of the negative plate, .650 kilog.; weight of the cell, 1.000 kilog.; weight of the liquid, 1.700 kilog.; weight of the cover, .200 kilog.; weight of the terminals, etc., .250 kilog.; total weight, 7.200 kilog.

A patent has been taken out for "tanning leather by electricity," by Mr. L. Gaulard. The skins to be treated by this process are suspended in a solution of tannin contained in a vessel, in the center of the bottom of which is an electrode, another electrode being placed in a conduit by which this vessel communicates with another vessel. The electric current is then caused to pass in such a manner that the negative pole is in the center of the vessel, and the positive pole is in the conduit. Under these conditions, the hydrogen alone acts upon the leather, and causes the rapid destruction of the nitrogenous matter contained therein. After undergoing this treatment for a period of eight days, the liquid in the vessel is removed and replaced by a stronger solution of tannin, making about twenty degrees. The current is then reversed, so that the pole in the middle of the vessel becomes the positive pole, and the pole in the conduit the negative pole. The oxygen alone then acts upon the liquid, thereby inducing a rapid oxidization of the tannin, and its precipitation in this condition in the cells formed by the gelatine and fibrine of the hide.

Conversion of Heat into Power.

In the introduction to a series of experiments carried out with Otto gas engines of the Stevens Institute of Technology U. S. A., Professor Thurston gives the following figures as illustrating the causes of waste in a gas engine: Out of the total amount of heat supplied, the work of the pump consumed .42; friction of mechanism, 4.10 parts; loss in exhaust, 23.55 parts; loss in water jacket, 46.90 parts; radiation, etc., 10.76 parts, leaving for useful dynamometric work only 14.27 parts out of the 100.

The Resistance of Saline Solutions.

In criticising the note recently presented to the French Academy of Science by M. Bouty, to which we called attention in these columns recently, M. Wortz remarks: "M. Bouty has shown that the electrical resistance of saline solutions is the same when they contain equivalent quantities. But the chlorides experimented with did not contain equivalent quantities of metal, and there is reason to believe that molecules so different in form and sizes will offer different molecular resistance to the current."

ELECTRICAL AND SCIENTIFIC

With one of the Skrivanow battery cells, weighing 100 grammes, M. D. Monnier recently obtained an E. M. F. of 1.45 to 1.50 volt, and a current of one ampère for one hour.

The Thomson-Houston Electric Company have lately received at their Boston office the bronze medal awarded them by the Southern Exposition, of Louisville, Ky., for the best arc light.

The Worcester Electric Light Company are expecting soon to add to their present plant of Thomson-Houston dynamo machines and lamps—new apparatus of the same kind sufficient to run another hundred arc lights.

The City Council of Fort Wayne, Ind., contracted, on Feb. 26, with the Fort Wayne Jenney Electric Light and Power Company to illuminate the city one year, beginning with July 1st. There are to be nine towers, with five lights each, on the outskirts, and sixty additional lights suspended over street crossings.

Orange, N. J., has a pledged capital of $40,000 for the formation of a company to provide the city with electric lights.

The promoters of the enterprise are Daniel A. Heald, H. B. Auchincloss, Henry C. Pedder, William Barr, Samuel Lord, Jr., Samuel Colgate, George Lindsley, Everett Frazier, and David Bingham.

Judge Ingraham, of the Superior Court, has given judgment in the case of the property owners in West 25th street, New York, *vs.* the Brush Electric Light Company. He holds that the company was authorized by the proper authorities to erect poles and wires, and the property owners have no more right to object than if the city did the lighting.

Some experiments have recently taken place at the telegraphic station of Strasbourg for the application of the accumulators to the telegraphs. Twenty Meidinger's elements have been replaced by five Schultze's accumulators, disposed in six circuits, loaded by a current of four amperes, and weighing ten kilogrammes. They are only thirteen centimeters (about five inches) in length by twenty-four centimeters (nine and one-half inches) in height.

We would inform our correspondent C. K. H. that the "Hockhausen" light, or Excelsior Electric Light Company, are doing something in the way of lighting in the East. They have a few isolated plants running in Maryland, and a central station at Philadelphia. We know of no "place where their lights have been superseded by others of better quality." In fact they have not been long enough in business for any such extraordinary proceeding to take place.

The population of Mexico is 10,000,000, and there are 146 cities, 372 towns, 4,486 villages, five missions, 5,689 haciendas and 14,605 ranches, besides 2,213 collections of groups of houses, denominated "congregations," "barrios," "rancherias," etc. Value of private real estate, rural, $773,000,000; private real estate in cities, $2,568,036,000; cattle of all kinds belonging to individuals, $126,000,000; property belonging to the nation, $240,000,000; total real estate, not including mines, coasts, bays, lakes, rivers, etc., $3,549,060,000; agricultural products, $177,451,086; industrial products, $14,000,000. So says the *North and South*, and we imagine it is very nearly correct.

The Brush Electric Light Co., of Buffalo, N. Y., having secured a large contract for street-lighting, are building a new station with a capacity of 600 lights. It will be equipped with ten 60-light dynamos, driven by ten independent engines of 65 horse-power each. The dynamos will be belted direct, and no counter-shafting will be used.

Thomas Whiteside Rae, C. E., and electrical engineer (member of the Society of Telegraph Engineers and Electricians, of London), has opened an office in the Boreal Building, 115 Broadway. Mr. Rae is well known in Europe and in this country, and is probably one of the ablest electrical engineers in this country to-day. He is the representative in this country of the India-Rubber, Gutta Percha and Telegraph Works, Limited, Telegraph Engineers and Manufacturers, London, England.

The City Council of Fort Wayne, Indiana, contracted, on the evening of the 26th ult., with an electric light company to light the streets of that city for one year, commencing July 1, 1884.

There will be nine towers with five lights each in the outskirts, and sixty additional lights suspended over street crossings in the central portion of the city.

The matter of using the electric light has been pending in the council for over a year, and has caused a bitter fight.

CHICAGO.—An announcement is made of the discovery of a new and remarkable motor known as "The Triple Thermic Motor." The new motive power is the vapor of bisulphide of carbon. It has been in practical use in driving a sixty horse-power engine for six months past in a cement paving manufactory in West Forty-sixth Street, New York. The discoverer of the means of applying the new power and the machinery adapted to its use is W. S. Colwell, formerly of Pittsburgh, who, it is stated, has been at work many years on their application.

In England some very interesting electric lighting experiments are about to be made in Wimbledon to determine the best mode of lighting public streets. They will be conducted by Mr. Preece, F. R. S., and are intended to determine the relative efficiency of arc and incandescence lighting, the proper distribution of the lamps, and the most economical and effective manner of diffusing the light. The engine and dynamo are in position. The experiments are independent of any system or interests, and are looked forward to with much scientific and public interest.

According to a Berlin correspondent, all the towns of some importance in Germany will soon be connected by direct telegraphic wires, so that a dispatch from Breslau to Cologne, for instance, will no longer have to pass through Berlin, as it does at present. Frankfort on-the-Main will be connected directly with Emden, wherefrom the American and English cables start; that will give a great saving of time. At the general telegraph office in Berlin the experiments, which we have heretofore reported, with dynamo machines instead of ordinary batteries, still continue and seem to give the most satisfactory results.

Reading Electric Light Company.

The stockholders of the Reading Electric Light and Power Company held their annual meeting last evening at the office of the company, No. 508 Court Street. J. K. Righter was elected Secretary and Treasurer, and the following directors were chosen: Thomas P. Merritt, Levi Quier, O. W. Stager, J. H. Cheetham, J. H. Miller, J. T. Valentine, Jesse Orr, D. W. Crouse, J. K. Righter. The Directors subsequently organized by re-electing Thomas P. Merritt, Esq., as President.

Units for Measurements.

The metrical unit for *length* is the meter; the ten-millionth part of the distance from the earth's equator to the pole.

The unit of *bulk* is the liter; it is the cube of a decimeter side.

The unit of *weight* is the gramme; the weight of a cubic centimeter of distilled water at 40° Fahrenheit.

The unit of *force* is the kilogrammeter, being the force required to raise one kilogramme weight one meter high.

The unit of *electric resistance* is the *ohm;* it is the resistance which a current undergoes when passing through a column of mercury one meter long and one square millimeter in section at the freezing point of water.

The unit of *electro-motive force* is the *volt;* it is the amount of electro-motive force produced by one Daniel cell.

The unit of *electrical intensity* is the *ampere;* it is the current produced by one volt through a resistance of one ohm.

The unit of *quantity of current* is the *coulomb;* it is the quantity of electricity given by one ampere in one second.

The Production of Electricity by Condensation of Aqueous Vapor.

Herr S. Kalischer has examined this problem, and published the result of his investigations in the *Annalen der Physik und Chemie*, of which the following abstract is given in the February number of the *Journal* of the Chemical Society:

"The production of electricity by condensation of aqueous vapor presents a problem of considerable meteorological importance as regards the origin of atmospheric electricity. It is, however, probable that the production of electricity observed is in most cases due to the friction between the water particles and the condensing surface. In this paper the problem is examined experimentally by means of an apparatus which permitted the condensation of aqueous vapor by cooling. It consisted essentially of a series of beakers filled with ice, and covered externally with tinfoil; the beakers were placed on a plate of galvanized iron connected with a quadrant electrometer, and the whole combination was enclosed in a metallic box. Although deviations of the needles of the electrometer were observed, yet they were of the same magnitude and direction whether the beakers were filled with ice or not; and, secondly, they were sometimes in one, and sometimes in the other direction. Other experiments are described in which air was compressed in, and then allowed to expand from, a vessel resembling the electric egg, the metallic stopcock of which was in connection with a quadrant electrometer. But in this case, although a pressure of 25 atmospheres was used, and the aqueous vapor fell in the form of fine dew on releasing the pressure, yet there was no development of electricity."

A very complete and successful installation of the electric light has been carried out on the Brazilian Steam Navigation Company's steel-built steamer Manaas, which has just left the Clyde, the builders being Messrs. James and George Thomson. It includes 99 Swan incandescent lamps, each of 29 candle-power, which are distributed throughout the main saloon, the state rooms, officers' rooms, as also in the steerage, the engine room, stokehole, tunnel, &c. The power is obtained from a Tangye "Soho" engine of 6 horse-power nominal; it drives two Siemens dynamo machines of the compound shunt-wound S D_2 type. These work at about 850 revolutions per minute, with the engine making about 180 revolutions. There are two circuits, with a combination main switch, which is adapted for joining them up, so that any portion, up to 60 lamps, may be worked by itself from either of dynamos. The contract was executed by Mr. Richard Miller, Glasgow. The Caledonian Railway Company, a few weeks since, authorized Messrs. Norman & Son, of Glasgow and Barrow-in-Furness, to light up in the same way the shunting yard in connection with the central station, Glasgow. The yard in question extends from the station platforms south, to the viaduct over the Clyde, a distance of about 300 yards, with a width of 100 feet, or even more in some places. Two Crompton's differential arc lamps are used, of an illuminating power of about 4,000 candles each, and designed for working a shift of nine hours, including the night and the morning. Placed at a distance of fully 100 yards apart, the lamps are raised to a height of about 50 feet from the level of the rails, and the poles from which they are suspended are 70 feet high. The current for the two lamps is obtained from a Crompton-Burgin dynamo, of the C type. It is considered most likely that the directors will very soon give orders for the central station at Glasgow being adapted throughout to the electric system of illumination, for hitherto the lighting by gas has been very inefficiently performed.

The magnificent but somewhat unfortunate screw steamer, Austral, belonging to the Orient Line, and which lay sunk at the bottom of Sydney Harbor during a period of some three months, has just been entirely refitted by her builders, Messrs. John Elder & Co., Glasgow. As on the first occasion, the electric lighting arrangements were entrusted to Messrs. Siemens Brothers, and carried out for them by Mr. J. S. Raworth, of Manchester. No provision has been made for lighting with oil lamps, entire reliance being placed on the Siemens system of electric lighting. The dynamo machines are two in number, both of the Siemens alternating type, and each capable of maintaining 200 Swan incandescent lamps of 20 candle-power. These machines are driven by two of Gwynne's vertical engines of 10 horse-power each, and capable of working up to 23 horse-power indicated, which is transmitted by an endless cotton rope in the manner first introduced by Mr. Raworth, and since extensively adopted by many other leading firms in the electric lighting industry. Both engines are fitted with Pickering's governors. The electric lighting extends to the whole of the ship. Every passenger cabin has its electric lamp; even the second-class and steerage portions of the steamer have not been overlooked in this respect; and the arrangements are such that the light may be turned on or off at pleasure by the passengers themselves. The installation has been laid down according to the general practice of Messrs. Siemens Brothers, which is now well-known on many of the large ocean steamers. All the lights are under control from fixed stations, and are turned off at a certain hour, with the exception of a number which are left in action all night in the passages and saloons. The night main leads also supply the captain's, officers', and engineers' rooms, the chart room, engine room, stokeholes, tunnel, refrigerator, and electric rooms, &c. Four powerful arc lamps, each of 2,000 candle-power, are fitted up over the deck of the ship, so that they may be used when she is in port at night coaling, or taking in or discharging cargo.—*Engineering, London.*

Two advantages are possessed by the electric furnace, and it is difficult to underestimate them. The temperature which can be produced is limited only by the refractory nature of the crucible, and the heat is developed first in the substance to be melted without traversing what contains them.

At Springfield, Ill., the following companies were recently incorporated: The Secretary of State licensed the incorporation of the following companie: The Western Cable Railway Company, at Chicago, to build cable railways; capital, $1,000,000; incorporators, Louis C. Wachsmith, Marvin A. Farr, and Edward L. Brewster. The Decatur Jenney Electric Light and Power Company, at Decatur; capital, $25,000; incorporators, K. H. Robey, Charles P. Thatcher, D. N. Brenneman, and J. C. Clokey.

TELEGRAPHIC

Two hundred shares of American District Telegraph Company, of Brooklyn, stock were sold on Wednesday, the 5th instant, by A. H. Miller & Son at 30 cents a share.

The cable service between Brazil and Europe has been interrupted, and all telegraph messages for South America are at present sent and received by way of Galveston.

The secretary of the West Coast of America Telegraph Company says that the tariff for telegrams from Great Britain to Buenos Ayres, and all stations in the Argentine Republic, *via* Galveston, is now reduced to 9s. per word.

The Chicago, St. Louis and Southwestern Telegraph Company, Chicago, has been incorporated; capital, $5,000,000; to operate overground and underground telegraph and telephone lines; incorporators, George W. Cass, William P. Elliott and J. O. Osborne.

NEW YORK.—Articles of incorporation of the Public Postal Telegraph Company were filed the 26th. The company proposes to operate lines in New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Iowa, Nebraska, Wyoming, Utah, Nevada, California, etc., upon the type-writing system—a patent which, it is stated, is owned exclusively by this company.

The Great Northwest Telegraph Company probably exceeded all its achievements of former years on Budget night. The number of words sent over the wires from Ottawa was 224,124. This prodigious piece of work was executed with the greatest possible amount of smoothness and accuracy. The operating staffs at Ottawa and at Toronto and other receiving points are entitled to the credit of having performed a feat which has not often been surpassed in any country. It has been very seldom that the reply of the Opposition to the Budget Speech has been printed on the next day after delivery. The work involved in taking down the speech, arranging the manuscript, telegraphing it, rewriting at Toronto, editing, setting in type, proof-reading, correcting, making up, stereotyping, and printing 27,000 copies can only be imagined by those who have gone through it.

ALBANY, N. Y.—A telegraph corporation was incorporated here on the 29th inst. under the name of the "Public Postal Telegraph." The general route of the lines as given in the certificate filed with the Secretary of State is from New York City through New Jersey and Pennsylvania to Cleveland; thence to Indiana and to Chicago; thence through Iowa to Omaha; thence across Nebraska to and through Cheyenne and across Wyoming to Ogden, and through Utah and Nevada to and through San Francisco, there to connect with submarine cables to be landed on the Pacific coast, and there land lines to San Francisco; from New York through Albany, Utica, Syracuse, Rochester, Buffalo, Niagara Falls and Lewiston to connect with a system of lines through Canada, and to continue from Buffalo west to Denver and New Mexico, through St. Louis to Portland, Ore., and to the City of Mexico; from Chicago to New Orleans; from Washington to Mobile; from Chicago to Mobile; from Syracuse, *via* Oswego to Canada; from New York, through Maine, to Canada; from New York through Vermont, to Canada; from Albany to Pittsfield, Springfield, Worcester, Boston, Lowell, Nashua and Manchester to Concord. All places on the above routes are to be connected, and it is also contemplated to connect all the cities and towns with such foreign cities and towns as may be connected with submarine cables laid, and to be laid from nations, etc., to either and all of the coasts touched by the Public Postal Telegraph's lines. The capital is $100,000, divided into 1,000 shares. The provision is made for the increase of the capital from time to time, until the same shall amount at par to $20,000,000. The subscribers to the capital are Ross C. Stone, of New York, 900 shares; Wm. D. Snow, Riverdale, 25 shares; Benj. F. Blair and Frank Rudd, of Brooklyn, 25 shares each, and George M. Brooks of New York, 25 shares.

Answer to Inquiring Investor in Telephone Stocks.

It is said that the People's Telephone Company, the parent Drawbaugh Telephone Company, controlling all the sub-telephone companies proposing to work under Drawbaugh's alleged inventions, reports from its office at 115 Broadway, New York, to the State authorities at Albany, officially, that "the People's Telephone Company has no earnings, and its stock.....value." We note the following interesting information from said reports:

"Total authorized capital of company, $5,000,000; whole number of shares of stock authorized, 100,000; number of shares of stock issued, 100,000; par value of each share, $50; amount paid into the treasury of the company on each share, $50; amount of capital paid in, $450 cash and $4,999,450 in patents and patent rights; amount of capital upon which dividends were declared, no dividends declared; date of each dividend declared, no dividends declared; amount of each dividend declared, no dividends declared; rate per cent. per annum of dividends, no dividends declared; amount of profit added to sinking fund, none."

* * * * * * * * * *

"Report and appraisement of the People's Telephone Company for the year ending the first day of November, 1883:

County of New York. } ss.:
State of New York. }

"On this fifth day of November, A.D. 1883, before me, the subscriber, a notary public in and for the County of New York, personally appeared Moritz Loth, treasurer, and A. S. Solomons, secretary, of the above-named company, who, being by me severally duly sworn, did say that the amount of capital paid in of said company is $450 in cash and $4,999,550 in patents and patent rights, and that said company declared no dividend in cash, stock, scrip, or of any other character or description during the year ending the first day of November, 1883, save the dividends herein reported, and that they will with fidelity, according to the best of their knowledge and belief, estimate and appraise the capital stock of said company at its actual value in cash, not less, however, than the average price which said stock sold for during said year, and not less than the price or value as indicated or measured by the amount of the dividends made or declared during the year; and that the amount of profit added to the sinking fund of this company during the said year, without a division thereof amongst its stockholders, was $....."

MORITZ LOTH, Treasurer.
A. S. SOLOMONS, Secretary.

Sworn and subscribed before me the day and year aforesaid.

FLOYD CLARKSON, Notary Public, 188, New York County.

Office of the PEOPLE'S TELEPHONE CO., }
NEW YORK, November 5, 1883. }

We, the undersigned, being the treasurer and secretary of the above-named company, do certify that, in pursuance of our aforesaid oaths, we have estimated and appraised the capital stock of said company at its actual value in cash as follows, viz.:.....shares at.....dollars and.....cents per share, amounting in the whole to..... dollars.

In witness whereof we have hereunto set our hands the day and year aforesaid."

MORITZ LOTH, Treasurer.
A. S. SOLOMONS, Secretary."

It will be noted by inquiring investors regarding this stock that the Secretary and Treasurer do not give any value, estimated or otherwise, upon the $4,999,450 in stock that has been issued for the patents and patent rights.

What are the patents in question?
To whom was the stock issued?
Why no value placed upon it?
Has there been none of it negotiated? If so, where do the proceeds appear?
Can the *Economist* explain?

Telegraph Schools.

TWO INSTITUTIONS OF THE KIND THAT PROMISE MORE THAN THE DEMAND FOR OPERATORS WARRANTS—INTENDING LEARNERS SHOULD BE CAREFUL.

Supt. F. H. Tubbs, of the Western Union Telegraph Company, said recently, that he was considerably annoyed by inquiries concerning the "Union Telegraph Company," which has located itself in a room on the top floor of No. 88 La Salle street, and advertises for pupils to learn telegraphy.

"Every day," said Mr. Tubbs, "and some times several times a day, parties come to me to ask if that company is connected with the Western Union, and if it is a reliable institution. I know nothing about it. I understand that it is simply a school for teaching telegraphy, and that the pupils are promised lucrative positions as soon as competent. Any operator can tell you that the supply of telegraphers is greatly in excess of the demand, and that there are thousands out of employment to-day. One of the unpleasant duties of my office is turning away applicants for positions, and I am often compelled to turn a deaf ear to worthy and competent men because there are no vacancies for them. A very different story is told at these telegraph schools. Only to-day a young lady came to my office and said she had visited the rooms of the Union Telegraph Company to find out on what terms she could learn telegraphy. While she was there in conversation with the superintendent, a messenger rushed in and said: 'The Western Union wants to know when you can send that lady operator you promised them.' The superintendent carelessly replied that the Western Union would have to exercise patience, and that he would supply them with operators just as fast as he could educate them. Now, if this young lady's story is true, that messenger must have been a sort of 'capper,' and the incident was a trick to convince the applicant that her services would be in demand as soon as she learned to handle an instrument."

A reporter, to whom these remarks were addressed, concluded to become an aspirant for telegraphic knowledge long enough to see what manner of man was at the head of the institution designated as the Union Telegraph Company. At No. 88 La Salle street he took the elevator to the top floor, and entered a room on the door of which was emblazoned the name of the company. It was a small apartment fitted up with a desk, a lounge, and two or three chairs. A man with gray hair and beard sat behind a pair of gold bowed spectacles at the desk, talking glibly to a young man who held a $20 bill in his hand. The young man was about to become a pupil in the school, and was requested to sign a paper, which he did. "I have a friend who will want to commence next month," he said.

"You had better induce him to commence at once," said the gray-headed man. "Our school may be full before that time."

When the young man had given up his money and departed, the old gentleman turned his spectacles benignly upon the reporter.

"Well, sir, what can I do for you?"

"You teach telegraphy here?"

"Yes."

"What are your terms?"

"For a full term $35, or you can come in for a month if you like. A full term is four months, and in that time you will acquire a thorough knowledge of telegraphy, both theoretical and practical."

"Are you the superintendent?"

"Yes, sir."

"How long have you been in Chicago?"

"Only a very short time; but our company is an old one. My home is in San Francisco, and this institution has been in operation there for years. It is a regularly incorporated company, and the only one of the kind in the United States. It has turned out a large number of first-class operators, all of whom are now in splendid positions and making lots of money. We also have an office in Philadelphia. Some of the best operators in Chicago are men who graduated in our institution in San Francisco or Philadelphia."

"Who are they?"

"Oh, I couldn't undertake to tell their names, of course, and you wouldn't know them if I did."

"Do you guarantee positions for your pupils when they become proficient in the art?"

"No, sir. That is something we never do."

"Then I have been misinformed," and the reporter made a motion to rise.

"I'll tell you what I will do," said the old man, hastily, "If you wish to learn, I will promise you this: If your behavior is good, I will, at the end of the term, tell you where you can get a position. But mind, your behavior must be good, for my pupils are ladies and gentlemen, and I will not tolerate any bad conduct."

"Are good operators in demand?"

"Always. There isn't a telegraph office in the country where good men are not constantly in demand. Permit me to illustrate. What is your business?"

"Clerk."

"Very good. You see in every issue of the daily papers where clerks are advertising for positions. You never knew a telegraph operator to advertise for a situation—never! No human being ever saw such an advertisement. They don't have to advertise; they are in constant demand," and the superintendent leaned forward and emphasized each word with a rap of his knuckles on the desk. "Besides your regular tuition," he continued, "you get the benefit of a course of lectures, and you learn every feature of telegraphy before you are finally turned loose."

During this conversation a reticent looking man, with a pencil riding his ear and a book hugged under his arm, was sauntering in and out, apparently in deep study.

"Is that the teacher?" asked the reporter.

"That is my head teacher," was the reply; "he is the ablest telegrapher in the country."

The reporter was afterward informed that this teacher was a Chicago man named Johnson, who had tried his hand at different times as a teacher of penmanship, stenography, and type-writing, and was now engaged to represent the Union Telegraph Company in Chicago.

Besides the little office there was a larger apartment in which were several tables, with chairs at each table. This was the school-room, but there were no pupils there, a fact which was explained by the superintendent, who said the day school closed at 4 o'clock, and it was not yet time for the night session to commence.

Assuring the San Francisco gentleman that he would think the matter over, the reporter departed and paid a visit to another telegraph institute, at No. 137 Madison street.

This place is run by "Moak & Hubman," in two dingy rooms close to the skylight, and the person who received the reporter was a comparatively young man. He said the institution had been in existence four years, and at present had thirty pupils. A term of five months would cost $25, with a course of lectures thrown in.

"Do you guarantee situations?" he was asked.

"No," he replied, "but we give our pupils such a thorough knowledge of the art of telegraphy that it is no trouble for them to secure situations. We put them in an office, and they are distributed around wherever they are wanted."

"You put them in an office?"

"Yes; a railroad office. There they await their chances, or are put into some vacancy immediately."

"You don't furnish situations for them yourself?"

"Of course not."

And yet the following advertisement appears in an evening paper:

WANTED—Gentlemen to learn telegraphy; $60 to $75 when competent; the only place in Chicago that can furnish their students with good railroad positions; open day and evening. 137 E. Madison street, room 15.

Telephonic News

It is reported that experiments were made recently with the telephone apparatus of the Michigan inventor, which he thinks can be utilized for talking across the ocean, and which he hopes to apply to the Bennett-Mackey cable, when laid. He claims to have solved the problem of adding a battery to a line almost without limit, by using simultaneously a number of independent local batteries of induction coils and deviating points, and says he can avert the danger of burning batteries by increasing the number of cells. Yesterday's experiments were with ten-point multiple telephone over 320 miles of wire between here and Washington. Morse instruments were working close to the telephone, and the induced current was so strong that a message going over the instrument could be read through a telephone receiver. He expects to try twenty Paine transmitters on the ocean cable, and thinks the current will be generated sufficiently strong to overcome resistance.

Telephone Doings at Frederick, Md.

The business of the company is still rapidly increasing here under the efficient supervision of Mr. E. L. Miller. The following article appeared in Saturday's issue, eulogistic, of the *Daily Evening News*, showing what our people think of Mr. Miller:

"A GOOD SUPERINTENDENT.—E. L. Miller, the kind and obliging superintendent of the Chesapeake and Potomac Telephone Company at this place, has been called to wider fields of action. His capabilities as a superintendent, which are manifold, possessing all the traits characteristic of one suitable to fill a position in which a good deal of push is required, has attracted the attention of the managers of the C. and P., and hence they have intrusted him with certain duties in Baltimore four days of the week. We dislike to be eulogistic, but, when it is deserved, feel no hesitancy in so doing"—EDITORS.

There has been some little change in our company here. Mr. G. Hoskins Morgan, formerly collector, has been appointed manager, and is very efficient in the discharge of his duties. He will, without a doubt, make a first-class manager.

At our carnival, on the 21st and 22d of February, the exchange building took the palm for handsome decoration, illumination, etc.

The company is now making arrangements to complete its lines to Baltimore, Washington and Westminster, the work having been stopped on account of bad weather.

The Drawbaugh people are trying to make some little stir here, having placed their stock on the market at $7.50 for $50 shares, but do not appear to be doing much. The interest of L. M. McMurray, one of our leading manufacturers in the concern, is its base here. Without the indorsement he gives, we believe nothing would be done.

The notice that both the *Morning Call* and *Evening News* have quoted from the REVIEW on this subject, if the article has done nothing more, it has swayed a powerful influence here for the American Bell people, the REVIEW being recognized as authority in electric, telephonic and telegraph questions.

ON TELEGRAPH MATTERS.

The consolidated office—W. U. and M. U.—is still under the efficient management of C. F. Kreb, with Cooper Smallwood and W. Crimmins as assistant operators, and is doing a good business.

The B. and O. office is in charge of G. G. Beckley, assisted by Edward Hallam; and like the B. and O., although this section of the country is doing a first-class business since the closing of the Mutual Union, most of its patrons went to the B. and O.

There is some talk of the Postal coming this way. We think it would pay some live company, like the Bankers and Merchants' or Postal, to open out here. MUNSON.

Perhaps some of your readers would like to hear what the telephone is doing in Arkansas. Well, the exchange at Little Rock is now something over four years old, has about 300 patrons, and is growing slowly but steadily. The company (Southwestern Division of the Erie) has just finished a line to the famous Hot Springs, about sixty miles southwest of here, where they have an exchange of over 100 subscribers. There are two wires—one for telegraph, the other for telephone purposes. The telephone wire is a new No. 9, iron soldered at every joint, on new poles, and first-class in every respect. Connections are made with subscribers of either exchange, and conversation carried on as easily and distinctly as on any of the local lines. The telegraph wire is an old one the company purchased, put on the new poles, soldered, &c. It works nearly or quite as well as the new one. The Little Rock exchange is equipped with six Weston's electric switches, new last fall. Has now 298 subscribers working on 274 wires (nearly all special wires, never putting more than one instrument on a wire unless it is very long or special request of the subscriber). Employs six operators, one inspector, and a lineman. Three young ladies do the day work, and are kept pretty busy, the exchange answering an average of 2,000 calls per day.

Telephone Company Rights.

A decision which practically settles the suit brought against Superintendent Morton, of the Central Telephone Company, as agent, forbidding him using the public streets of Keokuk for planting telephone poles for his company, was rendered by the Supreme Judicial Court of Massachusetts recently. The cases are identical. The hearing in the Central Telephone Company was had about two weeks ago, but the judge has not yet given his decision. The two cases are so nearly alike in all their aspects that Superintendent Morton is confident of victory. The Massachusetts suit was brought to enjoin the selectmen of Brookline from giving permission to the American Rapid Telegraph Company, under a public statute, to construct a line of telegraph on certain highways in that place. The objection raised was that the statute itself was unconstitutional. It is held by the Court that the use of a portion of the highway for the poles and wires of a company formed under the State, for the transmission of intelligence by electricity, and subject to the supervision of the local authorities, is a public use of the kind for which the land was originally taken. In other words, when the land was acquired for a highway, it was not intended to limit the public uses of it to the vehicles then known, or to the methods then in vogue of transmitting intelligence or conveying property; and the use of the highway for telegraph lines ranks with its use for gas and water pipes and horse tracks, as a new way of exercising the old public easement. All such methods of use must be deemed to have been paid for when the land was taken and the road laid out.

Telephonic Railway Signals.

A telephonic system of railway signals is being perfected, it is said, by a Chicago company. The arrangement, briefly described, is one whereby if a switch is left open, either by neglect, intentionally or by accident, the whistle of an approaching engine on the main line, be it a mile or more away, will be blown and an alarm bell rung. The engineer then bringing his train to a halt is enabled immediately to make a telephonic communication without leaving his seat in the cab of the engine, and ascertain the occasion of the alarm. The combined inventions are used to several desirable ends in the railway signal service, and are said by experienced railway men to be the most important, valuable electric telephonic devices yet heard of.—*Railway Age.*

The dawn of April 1st was drawing near. The hour hand of the clock pointed straight at the V of the dial, while the minute hand stood bolt upright. The last musical chime five trembled away. A few moments' of silence, and then came a rattling, rapid ringing. The lady got up, and exclaiming, "Oh, dear! there goes the telephone bell; must be a fire or something!" stumbled across the room, finding the rocking chair and two straight-backs on the way. Reaching the telephone she cried, "Hello! hello! What is it? Did you call?" only to hear her husband's laugh and "Don't be a fool, my dear, if it is the 1st of April. Better learn to tell the telephone bell and the alarm clock apart." Groping back in the dark, interviewing the rocker and straight-backs again, she probably wished she was a man, so she could "d——n the telephone!"

Overland Telephone Stock Unloading on the Philadelphia Lambs.

A CHARGE AND DENIAL OF FRAUD IN INDUCING OTHERS TO PURCHASE IT.

The contention between Geo. W. Bratton, on the one hand, and Thomas F. Harrison and Morris H. Alberger, on the other, in reference to stock of the Overland Telegraph and Telephone Company, which culminated several weeks ago in Bratton's filing a bill in equity against the others, has been complicated by the filing of a cross bill by the corporation itself against all three of the abovenamed individuals. Bratton alleged in his bill that Alberger had failed to comply with agreements made with him, and asked the court to grant an injunction restraining the transfer of any stock pending the litigation.

The company avers, in its cross bill, that Bratton, Alberger and Harrison entered into a conspiracy to defraud the eleven gentlemen whom they induced to subscribe $5,000 each for as many shares of the stock of the company, by falsely pretending that the Overland Telephone Co., of New York, which granted the license for this State to the corporation in this city, demanded in payment therefor $50,000 in cash and 40,000 shares of stock, while only $7,500 in cash and 10,000 shares of stock were really demanded.

It was averred that Alberger engineered this fraud, and that Bratton assisted by saying nothing when Alberger represented that he had no greater interest in the company than the other gentlemen whom he induced to subscribe, among whom were Colonel A. Loudon Snowden, Charles D. Middleton, Edward C. Amer, B. A. Vanschaick and Edmund L. Levy, all of whom are members of the Gentlemen's Driving Park Association.

These Overland folks seem to have got into the same snap that some of the People's did not long since, when they were obliged to refund the five thousand which they had extracted from a supposed lamb.

Foreign Telephone Statistics, Jan. 1, 1884.

COUNTRIES.	TOTAL NUMBER OF TOWNS USING TELEPHONES.	TOTAL NUMBER OF INHABITANTS.	TOTAL NUMBER OF SUBSCRIBERS.
Great Britain	77	11,124,391	7,287
Italy	16	2,564,522	5,507
France	18	4,576,908	4,437
Germany	21	3,709,324	3,643
Canada	10	400,196	3,256
Belgium	6	852,649	1,941
Sweden	5	300,283	1,554
Russia	6	2,002,000	1,351
Netherlands	4	639,000	1,340
Austria	3	1,632,779	870
Switzerland	2	142,000	825
Norway	2	135,801	745
Mexico	1	210,000	700
Argentine Republic	1	230,000	700
Australia	4	484,000	637
Denmark	1	261,360	516
Brazil	1	274,972	500
Cuba	1	.....	460
India	5	2,031,250	321
Sandwich Islands	1	40,000	260
Egypt	2	493,214	193
China	2	439,144	99
Portugal	2	343,389	80
Cape of Good Hope	2	52,000	47
Spain	3	795,000	.....

A Glimpse at the Central Office of Twelve Hundred Telephones in Indianapolis, Ind.

HOW THE NEW SYSTEM IS WORKING.

"How about your new exchange?" was recently asked of Superintendent Hockett, of the Central Union Telephone Company. "Is the misery pretty nearly over?"

"Just about over," was the reply. "Moving into our new quarters was a long and tedious operation, and the severe weather has increased the difficulties. But this week completes the business of transferring the lines, with some few exceptions; and in our new exchange we have every new appliance and facility to give Indianapolis the best telephone service in the United States. Come up and see our arrangements," continued Mr. Hockett. "I think you will notice a very marked contrast between the methods of the old and new exchanges"

"Our State and outside business is now transacted in an entirely separate office from the city," he explained, as a room was entered in which three young ladies were engaged in receiving and transmitting calls. At least 150 places can now be connected with this city, the most distant points being Cincinnati, Toledo, Lafayette, Paris, Ill., Richmond and Vincennes. The ease with which a conversation can be kept is not so much affected by the distance as the directness of the line and the condition of the atmosphere. Where connection can only be made by passing through two or three exchanges there is a difficulty in hearing, and it is a mistake to think that talking loudly helps the matter at all. Some people never learn how to talk by telephone, because they do not speak clearly and distinctly, and therefore do not get a satisfactory service. I have talked frequently the longest distances, and have used no louder tone of voice than I do now. The calls from city customers for connection with outside points are received at the City Exchange; the party calling is first connected with this room, and then with the point called by a much easier, prompter and more certain method than could have obtained in the old exchange. How it is done you will see more clearly when we get into the other room."

The general exchange, which was next visited, was found to be a large, high and airy room on the third floor, the appearance of which, and indeed everything connected therewith, presented a most noted contrast with the miserably dark, cramped and ill-ventilated quarters formerly occupied in the old Western Union building. In the old exchange there used to be a constant and confusing hum of conversation, as the girls at the several "receivers" have repeated the calls to their companions at the switchboards. Every one who visited the old exchange came away with a profound expression that it was no marvel if in such a scene of confusion and babel of voices the wrong connection was made for about every other call received. The wonder was not that that mistake occurred, but that any kind of a decent service could be given.

"You notice a difference, don't you?" said Mr. Hackett. "The fact is, there is no reason for any noise whatever here. There need not be a sound heard when we get every thing working just as we expect to have it. Here is one of the young ladies who is wearing what we call a telephone cap, by which she wears a receiver to her ear all the time she is on duty. It seems to be a success. She suffers no inconvenience from it, and spares all the labor of lifting the receiver up and down to her ear, and is at the same time protected against any possible danger from an electric stroke during a thunder storm. When all the girls use these telephone cap receivers, they will be able to hear and respond to calls without scarce a possibility of delay or mistake, and the response to the call can be done so quietly that there will be no noise or confusion to distract the attention of the operators. Let me explain to you the plan upon which our switch-board is arranged. It extends, as you see, the entire length of the room. It has connection with about 1,200 telephones, with room on the

switch-board for as many more. The feature of the plan upon which the switch-board is arranged is that while each operator has control of from seventy to ninety telephones for receiving calls, she has before her, within a distance of five feet, the facilities for direct connection with the entire list of subscribers. There is no calling to another operator to make the connection, which would involve delay, and sometimes confusion and mistakes, but when a call comes in, and the number required is ascertained, all the operator has to do is to pull down one of a number of pegs which hang before her and insert it in the switch-board at the number required. Then the through connection is made. If the number called is talking with some other number on the switch-board, the operator discovers that to be the case by finding the number blocked when she attempts to insert the peg, and so informs the subscriber. When subscribers are informed that the party called for is talking, they must accept that as final, and the operators are not allowed to argue the matter with them. The rules are so strict, and the method of detection so easy and prompt, that none of the operators will risk telling an untruth about the matter. All the responsibility, you see, now rests with one operator for responding to calls and making connections for a given set of numbers, and if a complaint comes there is no difficulty in at once locating the neglect. There can be no division of the blame, and that makes the operators careful, prompt and correct. When a call is made for an outside station, the operator in the City Exchange connects the caller with the State Exchange, by pressing her finger upon a little brass button on the table before her, and further communication is then made direct through the State Exchange. Our entire system is we believe, as complete as that of any city in the United States—there are, in fact, only two cities, Baltimore and Milwaukee, that have all the improvements which we have in use here, and we expect by strictly enforcing the rules governing our operators to give a service which will fully satisfy the requirements of the public, and in which the defects that have heretofore caused complaints will be entirely remedied.

The Problem of the Wires.

EXPERIMENTS WITH UNDERGROUND TELEPHONING AND DISCOURAGING RESULTS—THE USE OF OVERHEAD CABLES—TROUBLES OF THE ELECTRICIANS.

"The fact is, there is no underground system which we could work," said General Manager Downs of the New England Telephone Company recently. "It is true there is an underground system in Paris, but the conditions are very different. Paris has a city below the ground, with streets and by-ways, which serve to accommodate sewers, pipes, and wires of every kind. To construct such a system in Boston would necessitate such an enormous outlay that it would be prohibitory. I don't know of any underground system for telephone wires other than that mentioned. In London, telegraph wires are carried underground, but as telephones are so much more sensitive, they could not be worked under the same conditions."

"Have you made any experiments with a view to testing the question?"

"Yes; we have two underground lines at work now. One runs from this office, 40 Pearl street; one to State street, and the other to the corner of Franklin and Washington streets. We picked out five of the best cables invented, and put them in pipes. There are five cables and seventy wires. All show induction of wire with wire, and retardation from influences in the earth. The results prove that with any of the present systems a line cannot be operated for any great distance. The influences I have mentioned would prevent the satisfactory working of a line as far as from here to Dover street, and would wholly kill a line to a town at any distance from Boston. We have been experimenting for a year and a half, and so far have had no satisfactory results, though wherever we have heard of anything on the subject we have investigated it. If the time comes when it can be demonstrated that any underground system is practicable, the companies will be only too glad to take advantage of it. They want to do so now, but they do not know how it can be done."

"You want to know why we keep our wires in the air and have all the bother from storms, fires, and other accidents, besides offending the eye? Well, I will tell you," said T. D. Lockwood, electrician of the Bell Telephone Company. "The underground system is an old idea. The first telegraph lines were underground, some wholly, some in part.

THE MORSE LINE BETWEEN WASHINGTON AND BALTIMORE

was underground as far as the Relay House, and the Cook & Wheatstone line from Paddington to London was also so constructed. These failed to work and were abandoned. The trouble with them was defective insulation. We have got over that difficulty in a great measure, but still have to contend with induction and retardation."

"Do none of the existing systems overcome the difficulty?"

"They do not. It is true that from 800 to 1,200 patents for such systems have been granted; but it is also true that the inventors do not know what the trouble is. They work with the idea of securing insulation, but that is the least of the difficulties."

"What about the systems in Paris and London?"

"In Paris all wires are underground, and if we had an underground city, as exists there, we should not hesitate in the matter. In London, only telegraph wires are underground, and they lead through pipes to the central office. The telephone wires are above ground, and cannot be worked underneath. A telegraph line can be worked where a telephone line cannot be, because the telephone is so highly sensitive."

"What has been your experience with underground wires?"

"The present large business came upon us suddenly. When we first commenced it was thought that 50 or 100 wires would do us. In 1880 the American Bell Telephone Company commenced to see that with their wires underground, although the first expense would be large, the cost of maintenance would be small, provided durability were insured and the system would work. In consequence of an idea of my own, five miles of cable, with about twenty wires, were laid on the Providence railroad between Attleboro and West Mansfield. The $20,000 which it cost lies buried there to-day. Such of the cable as has not been stolen lies there useless. The experiment was a failure because of the induction between wire and wire and retardation by earth currents. Even with the ordinary telegraph much retardation in cables is found. While forty words a minute can be sent on an overhead wire, only fifteen words can be sent in the same time on the Atlantic cable. The effect of retardation is to run one sound into another. With 5,000 inflections of the human voice in a second, you can judge of the effect on a telephone. On twelve miles of submarine wire laid at Block Island, articulation was completely choked. Two miles is the limit for work on underground telephone wires, and then they do not work as well as when overhead. As to induction, I will show you an experiment."

Mr. Lockwood here connected a helix of wire in circuit with a battery and a vibrating circuit-breaker. He then took a telephone and placed it

IN CIRCUIT WITH ANOTHER HELIX,

which he moved in close proximity to, but without any contact with the first helix. Induction was heard while the two were several inches apart, and when five sheets of glass were intervened as an insulator, the sound was as distinct as before.

"Now," said he, "you can see how induction affects the telephone. The instrument at my desk is connected with the central office by a cable, and I frequently hear workings of telegraph instruments by induction. So many wires terminate on the earth in this city, that the ground is charged with all kinds of electricity. Here are specimens of cables insulated with rubber, paraffine, etc. When we cover each wire with tinfoil and connect with earth we can overcome induction, but this increases retardation, and so, between the two, we can do nothing. They are the Scylla and Charybdis between which we are wrecked."

"How do the State and Franklin Street cables work?"

"They work for their short distance subject to three difficulties, but we have found that when an underground wire is connected with an overhead one we cannot work it. Thus a man at the State street end could not talk with a man, say at Jamaica Plain, so that the suburban system could not connect with an underground system in the city. The cable experiment here has cost over $40,000. It has shown that if we had never more than a one mile radius we could give a service such as it would be, but we could not satisfy the demand for outside service. We are always trying to find out how we can overcome these difficulties, and some day we will find out, but we have not done so yet. When we do, it will be money in our pockets."

"Can you suggest any improvement on the ordinary overhead wire?"

"I like the overhead cables. We can put 2,000 wires in twenty of them, and as the wires are protected by the covering, all danger from 'crosses' is removed. We want to get whatever is best, and have shown this by buying over 600 patents of various kinds."

"Are experiments with underground wires being made elsewhere?"

"In New York the Western Union is putting underground wires from the up-town to down-town offices. There is also a committee there from all the electrical organizations in the country, of whom J. P. Davis, formerly of Boston, is chairman. They are endeavoring to find out what can be done in the way of underground systems. If a practical one is found for the telephone it will be adopted, whatever the trouble and cost, but until it is discovered we can do nothing."

The Societe Internationale des Electriciens.

This society, although only recently started in Paris, has already developed into a numerous and thoroughly representative body. It now counts some 1,200 members, of whom about 300 are foreigners, including nearly 100 English. The honorary president for France is Monsieur J. B. Dumas, secretary of the Academy des Science, and the executive president is Monsieur Georges Berger, well known to most electricians as the chief commissioner of the Paris Electrical Exhibition of 1881, and to whose exertions and *savoir faire* the great success of that greatest of exhibitions was undoubtedly due. The first regular monthly meeting of the society was held in the lecture theatre of the Societe de Geographie, Paris, on Wednesday evening, the 6th instant, and was fully attended. Monsieur Berger presided, supported by Messrs. Blavier, Tresca, Jamin and Loewy, vice-presidents. After some formal business, the meeting elected the members of the committee to represent each of the following countries: Those chosen for England were, honorary president, Sir Chas. Bright; members, Mr. W. H. Preece, of London, and Mr. J. Aylmer, of Paris. The other honorary presidents elected were, for Germany, Dr. Helmholtz; the United States, the Hon. L. P. Morton; Russia, General Velitscho; Belgium, M. Melsens; Italy, Professor Rossetti; Spain, Senor Urena; Holland, Professor Bosscha; Norway, Dr. Broch; Sweden, M. Curchod; Portugal, M. de Pania. A couple of papers were then read by M. Carpentier and M. Gaulard, and after a brief discussion the meeting broke up.

H. B. L. says the only sure preventive against Western rivers rising would be for him to own a few shares in 'em.—*T. B. D., Old Guard.*

BROOKLYN NEWS.

Brooklyn—the big and sleepy village, that never in the past could even pay expenses—just think of it, now has no less than three District Messenger companies, four separate telegraph companies, and somewhere in the neighborhood of 100 offices, all trying to serve the public incidentally and their own private purposes primarily, and this outside of the many public telephone offices.

This is certainly marching onward to some purpose, and it is safe to assume that this is only the beginning.

Severe snow, sleet and high wind storms serve one purpose from an electrical point of view.

While they are by no means a source of pleasure or profit to the companies concerned, they nevertheless show pretty clearly the character and stability of the lines put up.

One of the notable expressions heard after such a storm now is:

"Our lines are rendered useless by those of other companies falling across them."

It is hardly necessary to state which company has the right to properly make use of this phrase. Only that one that came to stay, and is there now.

The electric light in Brooklyn is not making any very rapid strides just at present. It may be said to be in a state of waiting—waiting for the people—that is the Board of Aldermen and the Mayor to say go ahead.

They don't say it, however, and so the light still remains under a bushel.

Buildings have been secured and engines put in, and, in fact, all arrangements made to furnish lights to a large number of those who have ordered them, but nothing further can be done until the consent to use the streets for the poles and lines has been given. This will, of course, have to come in time.

In the meantime none of the long lines of bright sunlike spots that are so conspicuous in the streets of New York are to be seen here.

This will no doubt be changed after the large conservative element gets its eyes fairly opened to the wants of the day.

When this town gets fairly started, it will set a pace that will astonish the beholders, and gas that was $1 a thousand feet last October was then made and is now $2 for the same.

If the telephone only had some kind of an attachment that would stand in the same relation to it that the key does to the other instruments of the telegraph, what an improvement there would be in its working, and what an excellent safety valve would be thereby furnished for the escape of the high pressure steam.

Just think of how a man will set and send a few dots or dashes—then tighten up a little—try it again and tighten a little more, become slightly astonished, and then try the other movement, loosen things a bit, keep on trying to send, and keep on giving the lever more play, until after it has been engineered sufficient it drops into the easy movement desired, and remains there until the next man goes through the same performance with the same result.

While this is being done, the tendency to become highly exasperated at something very irritating is overcome, and the nervous system is kept in its normal condition.

Why, therefore, can't a key attachment be fixed to each telephone, even if its function is only intended to affect the imagination?

What a relief it would be, if, when you have been struggling hard to distinguish the words—the voice comes all right—you could begin to tighten or loosen something connected with the machine, and keep on doing so until your adjustment had made the words as easily distinguished as the voice.

As long as you are working on this part of the apparatus you will be more likely to go easy on the company, and the rest of the instrument, and may even go so far as to believe that perhaps the trouble is after all with yourself.

Is not the experiment worth trying?—*Mac.*

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In re the Right of Way of Telegraph and Telephone Companies.

The question as to the right of way of telegraph companies is an exceedingly important and interesting one, for the principle upon which it it based is by no means restricted to telegraph companies but also to telephone companies, elevated railways, and the like. This question is particularly interesting at this time because of the likelihood in the near future of the building of greatly extended systems of telephone and telegraph lines.

Owing in great measure to the fact that most of our legislators are lawyers and that most of the laws have been made by lawyers to be expounded by lawyers, it often happens that enterprises which are likely to greatly benefit the public are retarded or hampered.

If the lawyers could agree upon the interpretation of the law, if they could only be sure of correctly elucidating these fundamental principles upon which they are in the habit of winding their verbiage, the practice would not, as now, be intolerable. But such is not the case.

Readers of the REVIEW will remember the case of Dr. Caro *vs.* the Elevated Railway Company. Telegraph and telephone men were, naturally enough, interested in the case because the question of right of way was seriously involved. Dr. Caro owned a fine house in Fifty-third street, and the elevated roadway, running immediately in front thereof, constituted a nuisance. The lower courts held that as the elevated company got its charter and right of way from the legislature it could not be adjudged a nuisance. Years passed by, during which Dr. Caro, the plaintiff, worn out by his long fight with the railway company, disappointed, indeed heart-broken from the crying injustice of which he was the victim, died. When the case reached the higher courts, however, the decisions of the lower courts were reversed. It was held that, it was the inalienable right of the individual to compensation where his property has been depreciated or in any wise injured, that though a State has the right of granting right of way to a railway or other company, it cannot give that company the right to injure or depreciate or appropriate private property without offering full compensation for such injury, depreciation or appropriation.

The States of New York and Illinois have affirmed this finding in the case of the Telegraph and Telephone lines, while the State of Massachusetts has, through its Supreme Court, denied the right of the owners of property over which the telegraph poles run to demand compensation. This being the case, it will not be surprising if some enterprising Yankees apply the same principle to the free right of way of an elevated railway.

We go into the question of right of way not in hopes of obstructing or curtailing the proposed lines, but, on the contrary, to facilitate their construction by placing the question of right of way squarely before the telegraph and telephone men of the country, in order to do away with and dispel the delusive hopes of running lines of poles across private domain without compensation. This always leads to litigation, which though good for the lawyers is very costly and aggravating to those having money invested in telegraphic enterprises, and can in the end lead to but one conclusion; viz: compensation must be given for injury sustained. All other decisions have very justly been held to be unconstitutional.

In the Illinois case recently decided one Barnett sought to recover compensation from the Board of Trade Telegraph Company who, with the full consent of the County Board, had run their line on the public highway in front of his farm. The plaintiff had judgment below, and the company carried the case up. Judge Scott of the Supreme Court delivered the following opinion:

"The position taken by defendant is that the State can rightfully, as it has done, authorize the county board to permit it to construct its line of telegraph upon the highway without the consent of the abutting landowner; that it imposes no new or additional burden thereon, and that when the public acquire an easement over land for a compensation fully paid, the public obtain all the rights the landowner had, and the State may authorize any use of it not inconsistent with its use as a highway. On the other hand, it is insisted that the proprietary rights of plaintiff have been interfered with in a manner detrimental to his interests as the owner of the fee, and that the action of defendant in taking possession of his land forcibly and against his will comes within the constitutional inhibition, 'private property shall not be taken or damaged without just compensation.' The latter position is the one best sustained by authority, and rests on sounder principles. It is for this reason the construction and maintenance of a telegraph line upon the highway is a new and additional burden upon the fee, to which it was not contemplated that it should be subjected, and for which the owner is entitled to additional compensation. The principle is, neither the State nor a municipal corporation has any rightful authority under the constitution to grant away the private property of the citizen, and if corporations quasi public, in the exercise of the right of eminent domain with which they are clothed by the sovereign power of the State seek to appropriate it so that they may have a benefit therefrom, every principle of justice demands that they should make just compensation, whether the property taken or damaged is of little or of great value. But aside from all considerations of right and justice the constitution has so declared, and its mandate in that respect may not be disregarded.

"See Indianapolis, Bloomington and Western Railroad Company *vs.* Hartley, the doctrine of which case has since been embodied in the text by Mr. Dillion in the recent edition of his valuable work on municipal law in a distinct section, and the author says it has for its support the sanction of some of the most eminent jurists in this country. At all events it is now the settled law of this State, and it is now too late to insist a different rule should be adopted. The principle of the Indianapolis, Bloomington and Western Railroad Company *vs.* Hartley is conclusive of the one being considered. What is there said respecting the right of a railway to the use of a common highway applies with equal force to a telegraph corporation. In the same sense the construction of a line of telegraph on the highway is an additional servitude to which the fee of the land had not before been subjected. The servitude differs more in degree than in character, and whether the damages are great or small the corporation asking for or appropriating to itself the benefit of such new servitude must make just compensation to the owner of the fee. In many and perhaps in most instances the damages may be merely nominal, but in others an actual detriment may be occasioned. That, of course, is a question to be determined from the evidence in each particular case, with which this Court has no concern."

In Massachusetts, on the other hand, the highest court has, as said before, affirmed a contrary opinion. In the case of Pierce *vs.* Drew, the plaintiff owned land on a certain public highway in Brookline, which is a suburb of Boston. They owned also a fee in the one-half of the street next to their abutting land. The defendants in this case were the select men of the town of Brookline, and were about, on the application of the American Rapid Telegraph Company, to grant to that company a location along the highway for their posts, wires, &c. In the action it was sought to restrain the defendants upon the ground of unconstitutionality.

The opinon of the majority of the judges delivered by Judge Devens, was to the following effect:

"In the case at bar the appropriation of property is for a public use. The transmission of intelligence by electricity is a business of public character, to be exercised under public control in the same manner as transportation of goods or passengers by railroads. The act of 1849, chapter 93, of which with additions P. S., chapter 109 is a re-enactment, recognized its public nature. (See Young *vs.* Yarmouth, 9 Gray, 386; Commonwealth *vs.* Boston, 97, Mass., 555; Bay State Brick Company *vs.* Foster, 115 Ib.) The public nature of this business has been recognized by the legislation of Congress, the decisions of the United States courts and of many of the States of the Union. So far as known to us it has not been held otherwise anywhere. (12 U. S. Statute, 489-772; 13 Ib., 365; 14 Ib., 292; Pensacola Tel. Co. *vs.* Western Union Tel. Co., U. S. 1.)

"As the chapter does not, in our opinion, provide for damages to the owner of the fee in the highway by reason of the erection of the telegraphic posts and apparatus, it is to be determined whether such a use of it creates a separate and additional burden requiring an independent assessment of damages for which the owner of the land was not compensated when the highway was laid out, and whether the omission of the act to provide this compensation renders it unconstitutional. It is to be observed that for more than thirty years the right to appropriate the highways to this public use without any compensation to the owner of the fee, therein has been asserted; that the statutes in regard to it have more than once been expounded by this Court without any apparent doubt of their validity, and that up to the present time no suggestion has ever been made that the rights of these owners were in any way invaded. During these years, if the argument be correct that these owners are entitled to compensation, the estates of thousands have been wrongfully used while they were either ignorant of their rights or submissive to injustice, and in the meantime costly telegraphic structures have been erected and the whole business of the State and country has accommodated itself to this system of the transmission of intelligence. After so long a practical construction by the Legislature, and after so widely extended an acquaintance by parties whose estates or interests therein are directly affected, it would require a clear case to justify us in setting aside such a statute as unconstitutional, even if it be true, as it certainly is, that no usage for any course of years, nor any number of legislative or judicial decisions, will sanction a violation of the fundamental law clearly expressed or necessarily understood. (Commonwealth *vs.* Parker, 2, Pick., 550, 557; Packard *vs.* Richardson, 17 Mass., 122, 144; Holmes *vs.* Hunt, 122 Ib., 505.) No right to take the private property of the owners of the fee in the highway is conferred by this act; all that is given is the right to use land by permission of the municipal authorities, the whole beneficial use of which had been previously taken from the owner and appropriated to the public. It is a temporary privilege only which is conferred; no right is acquired as against the owner of the fee by its enjoyment, nor is any legal right acquired to the continued enjoyment of the privilege or any presumption of a grant raised thereby. P. S., chapter 109, section 15.

"It has never been doubted that by the authority of the Legislature the highways might be used for gas or water pipes intended for the convenience of the citizens, although the gas or water was conducted thereunder by companies formed for the purpose, or for sewers whose object was not merely the incidental use of cleansing the streets, but also the drainage of private estates whose rights to enter therein were subject to public regulation therein. (Commonwealth *vs.* Lowell Gas Light Company, 12 Allen, 75; Attorney General *vs.* Metropolitan Railroad, 125 Mass., 517; City of Boston *vs.* Richardson, *supra.*) Nor can we perceive that these are to be treated as incidental uses, as suggested by the plaintiff, because the pipes are conducted under the surface of the traveled way rather than above it. The rights of the owner of the fee must be the same in either case, and the use of the land under the way for gas pipes or sewers would effectually prevent his own use of it for cellarage or

similar purposes. When the land was taken for a highway, that which was taken was not merely the privilege of traveling over it in the then known vehicles, or of using it in the then known methods for either the conveyance of property or transmission of intelligence.

"Although the horse railway was deemed a new invention, it was held that a portion of the road might be set aside for it, and the rights of other travelers to some extent limited by those privileges necessary for its use. (Commonwealth *vs.* Temple; Attorney-General *vs.* Metropolitan Railroad, *supra.*) The discovery of the telegraph developed a new and valuable mode of communicating intelligence. Its use is certainly similar to, if not identical with, that public use of transmitting information for which the highway was originally taken, even if the means adopted are quite different from the post-boy or the mail coach. It is a newly-discovered method of exercising the old public easement, and all appropriate methods must have been deemed to have been paid for when the way was laid out. We are, therefore, of opinion that the use of a portion of the highway for the poles, etc., of companies formed under the law of the State for the transmission of intelligence by electricity, and subject to the supervision of the local municipal authorities, which has been permitted by the Legislature, is a public use similar to that for which the highway was originally taken or to which it was originally devoted, and that the owner of the fee is entitled to no further compensation."

There was, however, a dissenting opinion, in which, as will be seen, the point that has been made by the courts of New York, Illinois and other States was vigorously affirmed and sustained. It was delivered by Judge William Allen, and is as follows:

"The great weight of opinion thus far expressed by courts is that, while street railways, with cars propelled by horse-power, are not to be regarded as imposing a new servitude which will enable the owner of the fee of the highway to additional compensation, steam railroads are to be so regarded. It is considered that the latter is so far different in its nature that the law ought to take notice that it could not have been within the contemplation of the parties that the laying out of an ordinary street highway should also include such a mode of traveling. While it is always recognized that the proper and contemplated use of the highways is not to be deemed limited to such vehicles as are in use at the time, it is conceded to be too great an extension of the easement acquired by the public to hold that it embraces its use for a steam railway. At this point the line has been drawn by the great weight of judicial decisions: In Williams *vs.* N. Y. C. R. R., 16 N. Y., 96; Wade *vs.* N. Y. Street R. R., 25 N. Y., 535; City R. R. *vs.* City R. R., 20 N. J. sq., 61; Greeley *vs.* U. Branch R. R., 26 Conn., 255; Grand Rapids R. R. *vs.* Husel, 38 Mich., 62; Sherman *vs.* Wisconsin Central R. R., 40 Wis., 645; Knehermann *vs.* C. C. & D. R. R., 46 Iowa, 366; Kaiser *vs.* St. Paul R. R., 22 Minn, 149, So. Pac. R. R. *vs.* Rend, 41 Cal., 256; Cooley Const. Lim. 546, 550, 2 Dill. Mun. Corp., secs. 722, 725.

"The use of a highway for telegraph purposes is not naturally included in the original design, or naturally incidental to its use for travel. Highways can be and and are conveniently used without telegraph or telephones. The latter can be established without the use of the highway. It may be convenient, in many instances, to use the highway for electrical lines. Whenever this proves to be the case, there is no hardship in requiring those who wish to establish such lines to pay for the privilege such damages, if any, as may be caused to the owners of property by such use. In many instances, no doubt, there would be no damages."

As to Arc Lighting.

Our esteemed contemporaries, *Engineering* and the *Electrical Review*, the two leading English scientific journals, the one devoted to science in general, including, of course, electrical science, and the other exclusively to the last mentioned, are paying unusual attention just now to the arc system of electrical lighting. Unlike an alleged electrical journal, which is a contemporary of theirs, whose hands are devoted to picking and stealing, and whose tongue is often engaged in lying and slandering, these two journals command respect wherever they go. In America, as in England, the two journals already mentioned are read by many, and therefore it is that we wish to say a few words regarding a discussion which has for some time been in progress in one of these journals, viz., *Engineering*, in the hope of correcting in the minds of our readers some impressions which, so far as America is concerned, are quite erroneous.

To read some of the communications which have from time to time appeared in *Engineering* regarding the arc lighting system, and even some of the comments made thereon by this journal itself, usually so accurate, the uninformed reader would conclude that the arc system was a total failure, designed only to delude the unwary and to entice golden shekels from unsuspecting pockets.

Singularly enough, letters evidently written by rival companies are admitted, containing fierce and unwarranted attacks on the arc system, even in the face of the fact that the arc system in England, as in this country, is used to a considerable extent, and is becoming more and more popular.

Here is a sample of these epistles, the author of which, it does not require the skill of a conjurot to determine, is directly interested in that ridiculous fizzle known as the Jablochkoff system:

ELECTRIC LIGHTING FOR STREETS.

To the Editor of Engineering:

SIR:—I thought my letter on the above subject, in your issue of the 25th ult., was sufficiently clear to elicit, if it deserved any notice at all, objections of a less ambiguous character than those of "Arc and Incandescent," and the "Secretary of the Hammond Company," in your issues of the 1st and 8th inst., respectively.

I cited facts resulting from my observations of the working of the five systems selected for the practical experiments of "electric lighting for streets" in London, which it is of course open to any one to verify, criticise, or contradict.

The former of your correspondents gives us the experience of a particular arc system the *rara avis*, no doubt, working somewhere; name of system and place not given. The latter tells us of an instance of fifty arc and forty-eight incandescent lights scattered over a surface of seven miles, and working with perfect reliability, at Brighton. As I am not aware of such an instance of electric lighting stretched over seven miles of *streets*, being in operation anywhere, Brighton included, *surface* probably means the lengths of circuits.

I am perfectly aware that in cases where the electric light is distributed to various consumers (not too distant from one another) a railway station or warehouse, for instance; the porters or assistants are expected, after a little experience, to give the temporary help required by "recalcitrant" lamps. The number of practical assistants in these cases may, consequently, not be very great, their services being required only for the more serious and persistent *attacks*, but this is *not* electric lighting for streets; although, even in street lighting the passengers have occasionally obligingly performed the necessary service. It is well known that in the attempt to light Prince's-street, Edinburgh, with Brush regulators, the best friends of the system were the street arabs who, independently of the men posted for the purpose, having become initiated to the mystery, made it their sport to jump upon the lamps and give the friendly *jerk* whenever a lamp was seen to go "a swooning." My observations had been, as a matter of convenience, concentrated more particularly on the line of lighting from the south end of Southwark Bridge to the foot of Queen Victoria-street, and I can assure "Arc and Incandescent" that to see the men running from lamp to lamp with a heavy ladder on their shoulders during the winter nights did not convey to one's mind that they were having a jolly time of it.

On the whole there is nothing in your correspondent's letter to make me alter my conviction that for the reasons I have given in my former letter, arc lamps of the regulator order are as unfit as ever they were to keep a line of streets lighted with the necessary amount of reliability without an expenditure for outdoor watching, out of all proportion to the otherwise moderate expense of producing and maintaining the light at the works; and that, always as regards electric lighting for streets on a large scale, the Jablochkoff system, being free from this incumbrance, has alone proved to be practically suitable. Yours faithfully,

ALTERNATE CURRENT.

49 Elsham-road, London, February 19th, 1884.

Imitating that terrestrial, rasorial bird, the emu, "Alternate Current" sticks his head in the sand, leaving a somewhat liberal expanse of posterior in mid-air, and thinks no one can see him.

Before going on we would like to ask him why it was that this Jablochkoff candle of his was ousted from the *Avenue de l'Opera*, in Paris, and from *Au Bon Marche*, *Au Printemps* and other large establishments? We would like to enquire of him why, though an attempt was made to introduce it in this country, where there are no prejudices against foreign systems, it proved a miserable failure from the very first, and not, so far as we know, gained a single friend?

He complains that a former correspondent who, it seems, was so bold as to answer a similar collection of drivel, of which he was the author, "gives us the experience of a particular arc system—the *rara avis*, no doubt, working somewhere; name of system and place not given. The latter tells us of an instance of fifty arc and forty-eight incandescent lights, scattered over a surface of seven miles, and working with perfect reliability, at Brighton. As I am not aware of such an instance of *electric lighting stretched over seven miles of streets being in operation* anywhere, Brighton included, surface probably means the lengths of circuits."

The italics are ours, the childish innocence is his. This is really too good. The Hottentot, following the same course of reasoning, could insist that it was ridiculous to allege that there was such a thing as the electrical telegraph, because for that he "was not aware of its being in operation anywhere."

We do not pretend to speak with authority about so unimportant a place as Brighton, England, but for the information of this somewhat incredulous person we would say that in the United States there are hundreds and hundreds of miles of streets lighted by the arc system of electrical lighting; that, indeed, many entire cities are lighted with it, and successfully, too. Nor is this by a system which might be regarded in any sense as a *rara avis*. On the contrary, there are several successful systems of arc lighting now in operation in the United States, and so efficient have they proved that orders are coming in from all parts of the country for more apparatus.

In New York City, where the two principal thoroughfares are lighted by the arc system, the authorities recently renewed their contract with the arc companies, and willingly allowed them an advanced price upon that fixed by the gas companies, by reason of the superiority of the light and the service generally. These lights have been burning constantly, now, for several years, and yet we do not recall a single instance where complaints have been made that they fell "a swooning," nor have we ever heard of foot passengers along the various thoroughfares offering their services to keep them in running order.

Unquestionably the most economical form of arc lighting is that wherein water-power operates the generators, and this form has not, we believe, ever been tried in England. At the Lower Falls, Rochester, N. Y., sufficient power is gathered from the river to electrically light up the entire city of Rochester without a dollar's expense for coals. But even, as said before, where the generators are worked by steam engines, the contracts for arc lighting are being continually renewed. Does this look like a failure of the system? We think not.

A Proposed Electrical Air Ship.

We expected—indeed, hoped—that the comparatively recent improvements in the storage battery would encourage enterprising engineers to apply the principle of stored energy to aerial navigation. In this we have not been disappointed. Tissandier, in France, is making some unique and interesting experiments in this science, wherein the storage system plays a by-no-means unimportant part, and both in England and in this country ingenious men have devoted not a little time to the subject.

But we must in candor confess we did not look for any such monstrosity as a man named Peterson, of Brooklyn, has evolved by a combination of gas and electricity; and if this extraordinary contrivance of Mr. Peterson's will do the half of what he claims for it—and this we respectfully ask leave to doubt—we may confidently look forward to the near future for the scientific millennium.

Mr. Peterson has organized, incorporated, and issued the stock of "Peterson's American Aerial Navigation Company," the prospectus of which bears a wood-cut of one of the air ships sailing gracefully over the Atlantic, many miles in air, with a line of three cars in its train, and more coming outside of the perspective of the picture. To be sure, there have been no experiments made as yet, and the belief that the air vessel will float is based upon theory; but that is a minor point, and if the experiment fails, the principle will remain the same.

In the prospectus, a somewhat elaborate and ostentatious affair, Mr. Peterson describes his aerial ship as an "oblong, horizontal, flat, reefable gas vessel." It has vertical masts and wheels, so that it may travel on the ground when starting or coming to a stop; is furnished with closed cabins that, the captain says, "will float the air ship on the water with as much stability as a sailing ship.' Then he goes on to say:

"At the after or stern end of the vessel is a horizontal guiding sail or rudder, pivoted to the ends of four inclined arms; said rudder has also steering gears extending to a steering wheel, and operated from the inside of the cabins. This rudder serves to direct the ship in any desired angle of vertical inclination. Wire bridges serve as communication between the four cabins, and as galleries for passengers and the crew on board. An apparatus for heating, as well as for cooling off the gas, is stationed inside of each cabin. A series of storage batteries serve to work an air-screw propeller shafted abaft each mast."

The balloon or ship is propelled by an electric motor, and is, according to one authority, thus:

If Mr. Peterson were to start from his shop in South Brooklyn to go to Liverpool, as he might just exactly as well to Paris or St. Petersburg or the Cape of Good Hope, the air ship rests upon its wheels in Mr. Peterson's backyard, and the gas is heated by means of the apparatus provided for this purpose. Heat expands it and increases its lifting power, and up goes the ship, head first, because the other end is weighted. It is navigated by means of a compass like a vessel at sea, and travels sixty miles an hour, according to Mr. Peterson, moving forward about a mile to each 100 feet rise.

When the ship gets up too high the gas is cooled, and the vessel begins to descend, and then, when it gets too low, the gas is heated again, and up she goes once more. Mr. Peterson calls each rising and lowering "a tack," and says that five of these "tacks" will carry the ship across the Atlantic. Arriving at its destination, the ship will descend into the street and stop on the crosswalk before the principal hotel, and the porters will assist to carry in the baggage. Children will not be permitted to eat peanuts in the cabin, and mothers must be careful not to let them fall from the window, as it would ruin the constitution of most children to drop so many thousand feet.

An experimental vessel is, it is said, in process of construction, and will be exhibited, says Mr. Peterson, at an early day. The commandants of English forts are especially warned, should they observe a mysterious monster sailing over them, not to mistake it for a Fenian emissary, and to abstain from firing at it lest they hit Mr. Peterson, who, we can assure them, is peaceably disposed.

The Cat Battery.

(PATENTED APRIL 1, 1883.)

Our esteemed contemporary *Life*, of the 6th inst., has the following interesting illustration of the Cat Battery by Mr. Carleton:

As early as 2306 B. C., Sarcophagus, the Egyptian philosopher, accidentally discovered the electric energy of the cat. Having accidentally sat upon his private cat one evening, while that pampered animal was taking a nap in the arm-chair, he was surprised to find himself enriched with a violently galvanic sensation, together with a sudden desire to stand up and say something. Subsequent investigations led him to the conclusion that the energy of the cat, like latent heat, might be developed by sudden compression. He gave this theory to the world in a celebrated treatise which he wrote that night on the mantel-piece; but eventually died without discovering the true nature of the phenomenon. But after this the domestic Egyptian cat was never sat upon—a fact which gave rise to the modern belief that it was a sacred animal. Two centuries later Obeliskus Mummi, the famous metaphysician of Memphis, while experimenting with two cats suspended from a clothes-line, observed that a strong repulsion existed between them, but was ignorant of its cause. Various other philosophers commented upon cats, and endeavored to explain these phenomena, but it remained for Benjamin Franklin to reveal the long hidden secret. Franklin's attention was called to the subject in a curious way. To weight his electrical kite, he had suspended to it, by the tail, his cook's cat. A thunder-cloud was passing at the time, and Franklin noticed the hairs of the animal's continuation separate and stand on end. This he knew was a sign of excitement, and he at once concluded that the excitement was electrical.

The results of his subsequent investigations are too well known to need reference; and the Franklin Theory of Cats is that great man's chiefest glory.

With this brief introduction we come now to practical elucidation of the principle upon which the Cat Battery works. Cats, according to Tyndall, are either electro-positive or electro-negative. When in the neutral state (see Plate I.), both fluids are combined, and the most sensitive galvanometer can detect no current. Thus insulated, neither *A* nor *B* exhibits either attraction or repulsion for surrounding objects, excepting for a hot stove or a piece of fish. But this affinity, according to the recent investigations of Siemens and Halske, is the result of chemical and not electrical attraction.

PLATE I.

Now, however, let us submit electro-positive cat *A*, and electro negative cat *B*, to exciting influences (see Plate II).

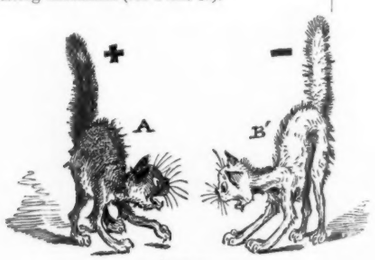


PLATE II.

Instantly we observe the development of electrical energy—*A* being strongly positive that he is the better cat, while *B* is as violently negative. This, as has been proved by the experiments of Prescott, Edison and others, is due to induction; each cat trying to induce the other to believe he isn't afraid.

This electrical state of activity is accompanied by all the well-known electro-static phenomena. The hairs of each cat stand on end, and surrounding objects—such as bootjacks, soap, cough-medicine bottles, and crockery—may be attracted with great velocity from distances of 100 to 250 feet.

Cats are absolute non-conductors. This fact was discovered in 1876, by Gerritt Smith, while vainly endeavoring to conduct a cat out of the coal cellar. It might be urged therefore, that they had high internal resistance. This is not true. The external resistance (again glance at Plate II.), is very high, but the internal resistance is never over one Ohm ("'ome," or "home," to give German, English and American terms), while in many cases it is less, and is witnessed by the fact that there are 1,317,009 ohmless cats in this city alone. But while the internal resistance is surprisingly low, the intensity is so high that by inductive influence alone two cat elements can maintain a whole neighborhood in a state of electrical excitement for hours.

PLATE III.

To utilize the currents generated by the action of the Cat Battery, and at the same time make it more constant, we resort to a simple contrivance, invented by the assistant electrician of the Eastern Union Telegraph Company. It consists simply (see Plate III.), of a bifurcated metallic spring-jack pin with a 20-lb. grip at *a*--*a*, provided with a binding screw *s*, and hole to insert wire at *e*. It is applied as shown in Plate IV.—the spring-jack gripping the tail *T*, at *b*, and the conductor being inserted and bound by the spring *s*.

PLATE IV.

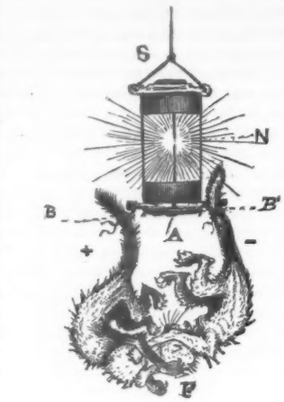


PLATE VI.

current constant for a considerable time, although Bunnell recommends that both elements, *A* and *B*, be well amalgamated with turpentine while setting the battery up.

Uniting a high electro-motive force with a quantity of many farads, the cat battery is found useful for the production of the arc light. Tillotson's arrangement is probably the best of these, and is shown in Plate VI. The electro-positive element is connected by stout copper wire to the lamp *S*, by the binding post *B*, and the electro-negative element similarly to *B'*. The sum of battery re-istance at *F*, will be found to exactly balance that of the arc *N*, hence no regulator is required, and a constant current is thus maintained until the battery wears itself out.

For batteries of high tension and immense quantity, four or more couples may be connected for intensity, as shown in Plate VII.

The couplings C C C C are of No. 18 copper, wound very tightly, and moistened with

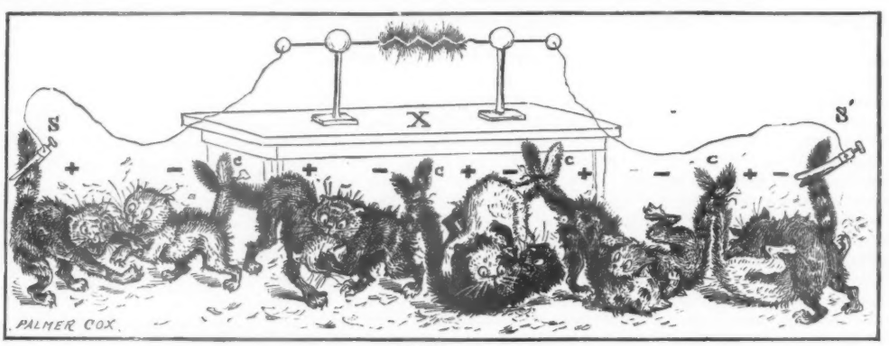


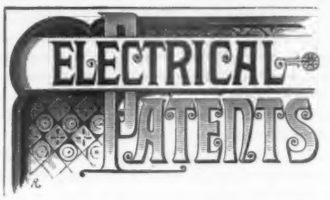
PLATE VII.

One complete set or couple of cat elements having, according to Haskins, a potential of 47 volts, the simplest form of medical battery is that shown in Plate V. The metallic tub is filled with hot or cold water, or both, from the faucets *M M*. The elements *A B* are thus excited, and the continuous current passes from the spring-jacks *c c*, to *F* and *B*, forming a complete circuit through the patient, as shown.

PLATE V.

As the cat elements reverse themselves very often during the action of the battery, no pole changer is required. The pressure of the spring-jacks *c c*, is found to keep the mustard. The terminal spring-jacks *S S'*, are of extra power, and convey the current to the discharger *X*, between the poles of which a vivid torrent of sparks will pass as long as the battery is in action. Sterns' recent investigations show that four such complete sets will develop a current whose energy is 9,000 volts, and whose quantity is 640 farads. The only drawback to the Cat Battery is found in the wear and tear of material, but as the supply in New York and Hoboken is practically inexhaustible, the Eastern Union Telegraph Company has found it to be the most economical in use.

H. G. C.



INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MARCH 4, 1884.

294,365 Conduit for underground electric wires; Henry B. Cobb, Wilmington, Del.

294,371 Watchman's electric time-recording system; George W. Davis, Freeport, Me.

294,377 Dynamometer; Franklin A. Gleason, Brooklyn, N. Y., assignor of one-half to John H. Swartz, Oyster Bay, N. Y.

294,384 Insulator for electric conductors; Albert W. Hale, Plainfield, N. J.

294,404 Automatic electrical cut-out; Charles S. Pinkham, Philadelphia, Pa., assignor of one-half to James J. Seal, same place.

294,455 Electric arc lamp; Hardman Arthur Earle, London, England, and Ewald Goltstein, Hanover, Prussia, Germany.

294,457 Composition for electrical insulation; John Fottrell, Philadelphia, Pa., assignor to Thos. S. Leigh, trustee, same place.

294,458 Dynamo-electric machine: George W. Fuller, Norwich, Conn.

294,463 Battery; Alfred Haid, Rahway, N. J.

294,464 Secondary battery; Alfred Haid, Rahway, N. J., assignor by direct and mesne assignments to Haid's Electrical Storage Company, Newark, N. J.

294,465 Secondary battery; Alfred Haid, Rahway, N. J., assignor by direct and mesne assignments to Haid's Electrical Storage Company, Newark, N. J.

294,482 Telephone central-office apparatus; Felton M. Lytle and John A. McCoy, Baltimore, Md., assignors to Henry B. Lytle, Boston, Mass., trustee.

294,532 Electric arc lamp; Charles J. Van Depoele, Chicago, Ill.

294,533 Electric lamp; Charles J. Van Depoele, Chicago, Ill.

294,537 Mandrel for cable presses; Richard S. Waring, Pittsburgh, Pa.

294,538 Compound electric cable; Richard S. Waring, Pittsburgh, Pa.

294,536 Compound electric cable; Richard S. Waring, Pittsburgh, Pa.

294,539 Mandrel for cable presses: Richard S. Waring, Pittsburgh, Pa.

294,540 Mandrel for cable presses; Richard S. Waring, Pittsburgh, Pa.

294,541 Electric cable; Richard S. Waring, Pittsburgh, Pa.

294,542 Mandrel for cable presses; Richard S. Waring, Pittsburgh, Pa.

294,543 Electric cable: Richard S. Waring, Pittsburgh, Pa.

294,544 Mandrel and die for cable presses; Rich'd S. Waring, Pittsburgh, Pa.

294,545 Electric cable; Richard S. Waring, Pittsburgh, Pa.

294,546 Making joint connections in electric cables; Richard S. Waring, Pittsburgh, Pa.

294,547 Mandrel for cable presses; Richard S. Waring, Pittsburgh, Pa.

294,548 Mandrel for cable presses; Richard S. Waring, Pittsburgh, Pa.

294,549 Repairing defects in the conductors of lead cables; Richard S. Waring, Pittsburgh, Pa.

294,550 Mandrel for cable presses: Richard S. Waring, Pittsburgh, Pa.

294,557 Manufacture of material for electric insulation; William Virgo Wilson, Jubilee street, Mile-End, county of Middlesex, England.

294,563 Insulator for electric wires; William W. Beach, New York, N. Y.

294,613 Commutator for magneto or dynamo-electric machines; Zenobe Theophile Gramme-Paris, France.

294,618 Grip for electric cars; John Carlos Henderson, New York, N. Y.

294,669 Automatic cut-out for electro-magnetic helices; Frank L. Pope, Elizabeth, N. J.

294,688 Dynamo-electric machine; Robert J. Sheehy, New York, N. Y.

294,697 Combined gas and electric light fixture; Luther Stieringer, New York, N. Y.

294,708 Underground conduit for electric conductors; Edmond Verstraete, Chicago, Ill.

294,717 Electric-motor; Murray Bacon, Philadelphia, Pa., assignor to the Novelty Electric Company, same place.

294,719 Dynamo-electric machine; Clinton M. Ball, Troy, assignor of two-thirds to John McKenzie, West Troy, and Joseph A. Powers, Lansingburg, N. Y.

BUSINESS NOTICES.

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New York and Pennsylvania Telephone Company	76	67
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Central Union Telephone Co.	100	90
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United Telephone Co. (Kansas and Missouri)	99	80
Bell Telephone Company, of Missouri	160	150
Wisconsin Telephone Company	120	115
Cumberland Telephone Co	100	95
Great Southern Telephone Co.	100	92
Michigan Telephone Company	100	97
Chicago Telephone Company	290	280
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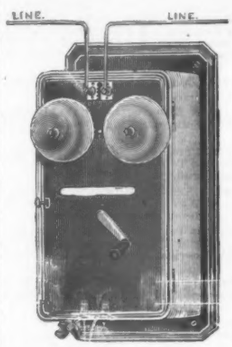

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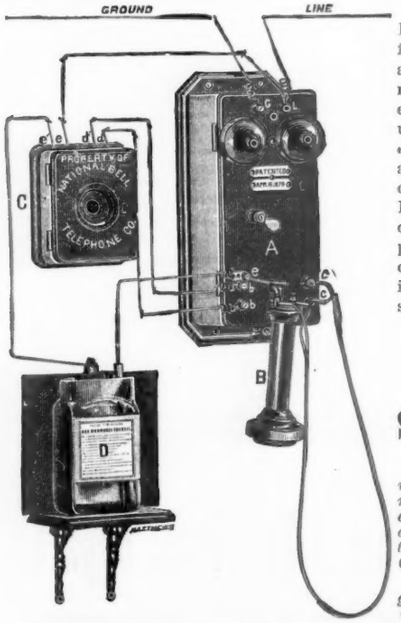

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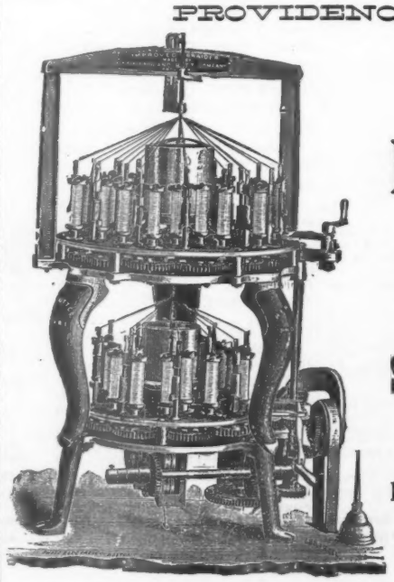

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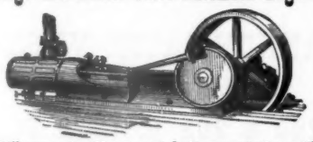

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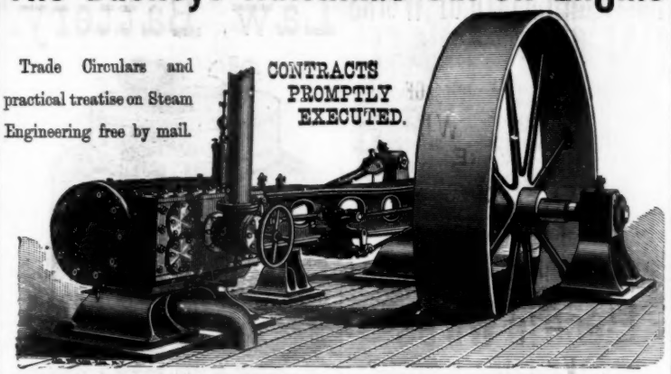

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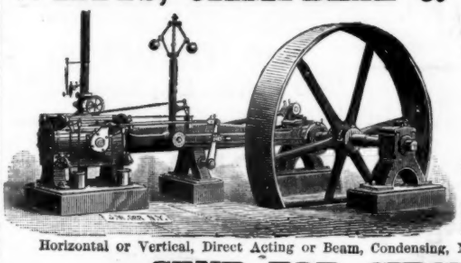

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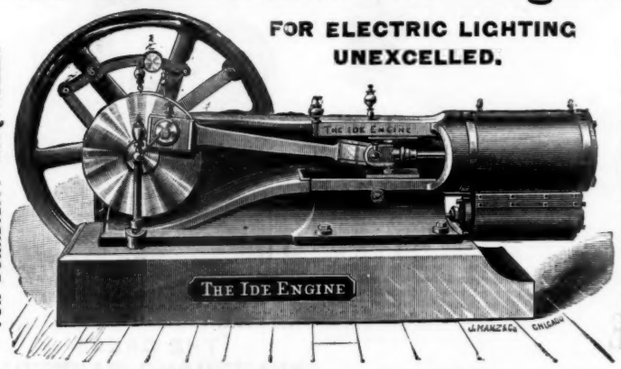

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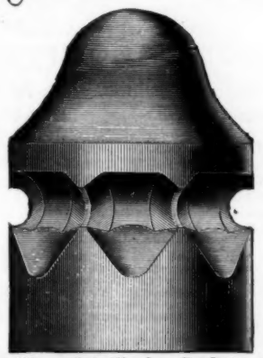

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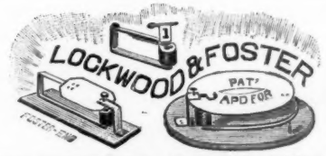

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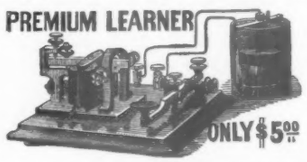

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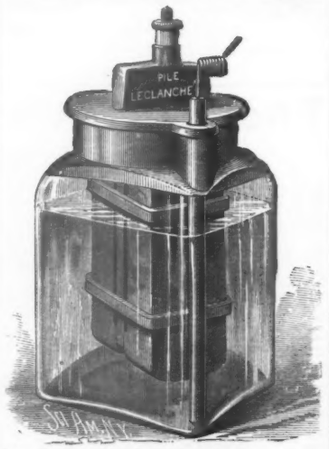

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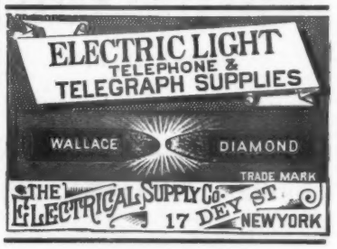

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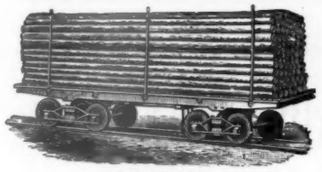

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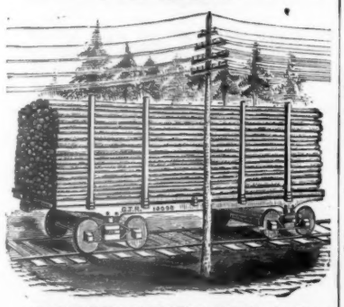

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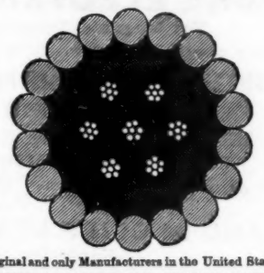

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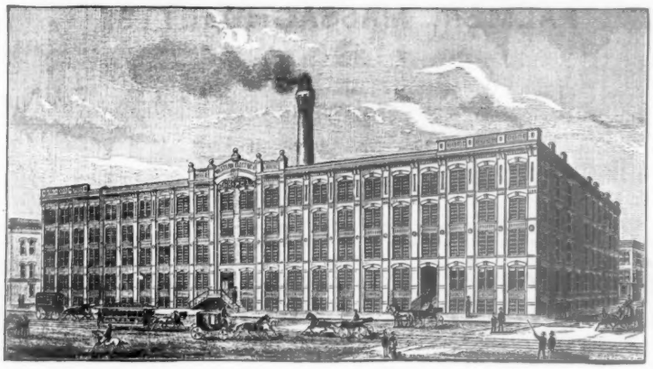

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